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## The Value of Orchiectomy in the Treatment of Carcinoma of the Male Breast<sup>1</sup>

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EXPERIMENTAL advance of the last decade resulted in the not unexpected discovery that sexual hormones play an important role in the causation of rather large groups of cancer. It was established from the earliest days of cancer investigation that one-third of all cancers occurring in the female and almost one-tenth of cancers occurring in the male originated either in the primary or secondary generative organs, but a documentary scientific explanation for this could not be furnished until recently.

The progress of research has been somewhat more swift, as is readily understandable, in the field of animal cancer and, therefore, a brief consideration of the more salient conclusions may not appear out of place.

Rhoads (1), in the Caldwell Lecture of 1942 before the American Roentgen Ray Society, reviewed in a comprehensive manner the wealth of experiments on the relationship of the sex hormones and certain types of cancer of the genitalia, as cancer of the breast of both sexes, cancer of the prostate, etc. In connection with cancer of the female breast in mice, he found evidence available pointing to the fact that in certain pure strains two factors are important in the causation of the neoplasm:

the hereditary factor, which is transmitted by the maternal parent, and a second factor, which is contained in the milk. If high-cancer strain offspring are foster-nursed on low-cancer strain mothers within twenty-four hours after birth, cancer of the breast develops rarely, whereas if low-cancer strain offspring are foster-nursed on high-cancer mothers, the cancer incidence rises from zero or thereabouts to 15 per cent. From this evidence, Rhoads deduced that, in the presence of both the hereditary and milk factors, the secretion of the ovary by rhythmically releasing estrogenic substances into the blood stream is directly responsible for producing cancer of the breast. The anterior lobe of the pituitary gland also plays a certain role by controlling the secretion of the ovary. As a further step, Murray transplanted ovarian tissue into castrated male mice of a strain in which the females possess a high incidence of breast cancer and thus he was able to produce experimental cancer of the male breast in a similar manner.

The theory of estrogenic causation of breast cancer in mice received additional support when, as a result of numerous and varied investigations, it was noted that the administration of ovarian secretion elicits in both sexes diffuse epithelial stimulation

<sup>1</sup> Read before the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America, Chicago, Ill., Sept. 24-29, 1944.

of the mammary gland which, after passing through successive stages of metaplasia, leads to malignant neoplasia. In most instances, because of the slowness of the process, on histopathologic analysis various stages of metaplasia are encountered at the same time until at one more critical point the change culminates in cancer. If this focus is removed, the next most advanced point undergoes a similar evolution, and so on until the process becomes regional or general. In the presence of an already existing mammary carcinoma, the administration of ovarian secretion makes the disease much worse. Contrariwise, the suppression of the ovarian secretion in certain well outlined experimental situations tends to forestall the development of breast cancer or, if one is already present, to slow down its progress.

If we accept the estrogenic origin of mammary carcinoma in the human being, it is reasonable to expect that some of the observations made in animal experiments should hold for both men and women. Especially the suppression of the function of sexual hormones should offer a fertile terrain of clinical applicability. Unfortunately, the problem is not so simple as it would seem *a priori*. In mammary carcinoma in the female, surgical or roentgen castration has been applied periodically for nearly half a century, and the conclusions as to its value are still far from definite. A recent review of the subject (2) permits the following rather vague deductions: (1) In the presence of osseous metastases, roentgen castration is beneficial in one-third of the cases of mammary carcinoma, producing symptomatic relief and perhaps some prolongation of life. (2) In local recurrences and generalized visceral metastases, roentgen castration is of no particular value, although sporadic favorable results are described in the literature. (3) In the operable group of mammary carcinomas, routine roentgen castration is considered a futile effort, having no influence on the final results. More recently, considerable benefit is being claimed from surgical castration (bilateral oophorec-

tomy) in the premenopausal stage, but the number of cases published is still too small to warrant final conclusions.

In mammary carcinoma in the male, castration, which is best accomplished by bilateral orchiectomy, is of recent origin. Furthermore, because of the rarity of breast cancer in the male as compared to the female, only a few cases are described in the literature. It is not surprising, therefore, that here, too, the conclusions as to the value of the procedure should be indefinite. Farrow and Woodard (3), in January 1942, published their experience in 3 female cases and 2 male cases of mammary carcinoma with bone metastases. All 3 female patients received male hormones with unsatisfactory results. Of the male patients, one likewise received male hormone (testosterone propionate), and in the other a bilateral orchiectomy was performed. In the first patient, the osseous metastases continued to spread, pathologic fractures developed, and death ensued in ten months. In the second patient, regression of the tumor and of the osseous metastases, with complete relief of pain, occurred in four months after operation. Roentgenograms of the skeleton revealed no further spread, and the formerly destroyed areas showed increased calcification, indicating healing of the lesion. The decrease of the estrogenic excretion as well as a stable 17-ketosteroid output following the orchiectomy were likewise striking features. Rhoads (1), referring to this work, states that when male hormone (testosterone) or female hormone (estradiol) was administered to the 3 female and 1 of the male patients, the treatment was promptly followed by a striking rise of the serum calcium with a rise of serum phosphatase and an increased output of calcium in the urine. This indicates that the sex steroids stimulated enormously the rate of growth of carcinoma metastases in the bone, driving calcium out of the bone and producing increased bone destruction. In the other male patient, in whom the orchiectomy removed at least one source of the sterolic

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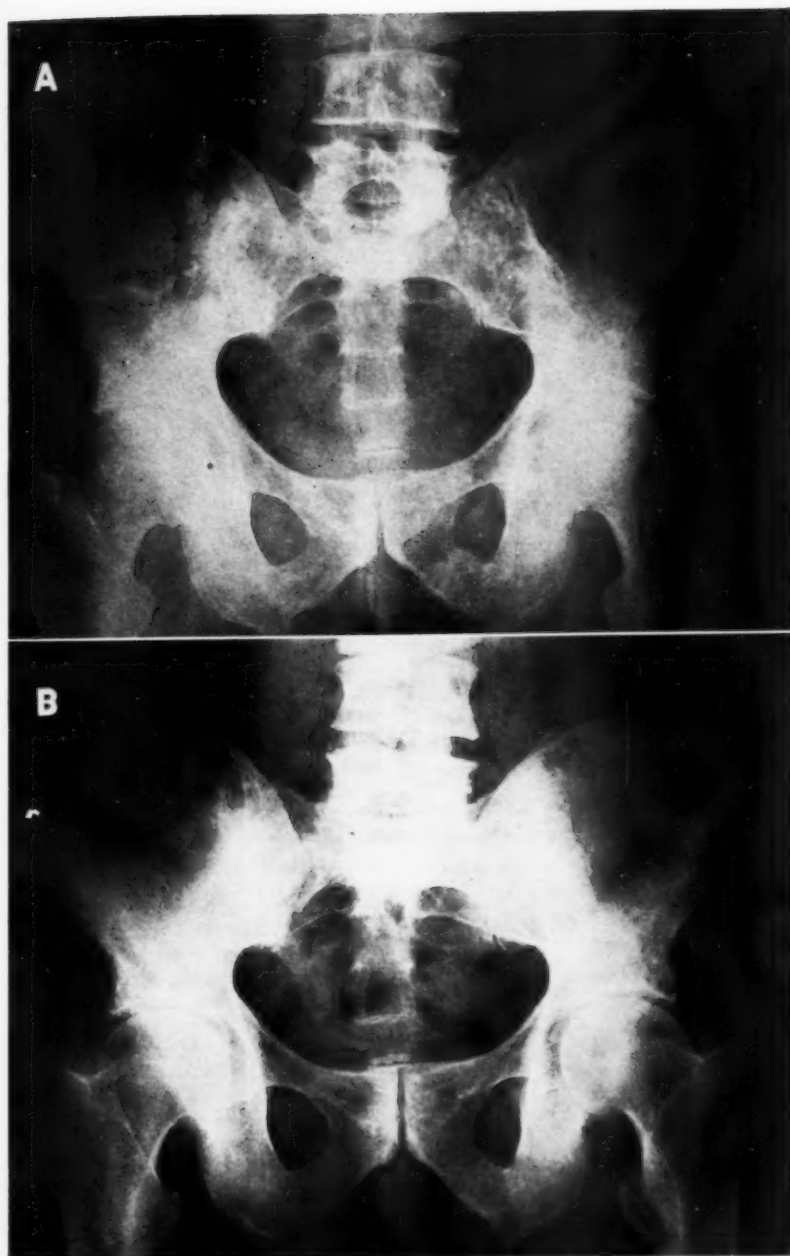


Fig. 1. Case I. A. Extensive metastases to the bones of the pelvic girdle, especially the iliacs, secondary to primary carcinoma of the male breast. B. The same patient one year after orchiectomy, showing complete reossification.

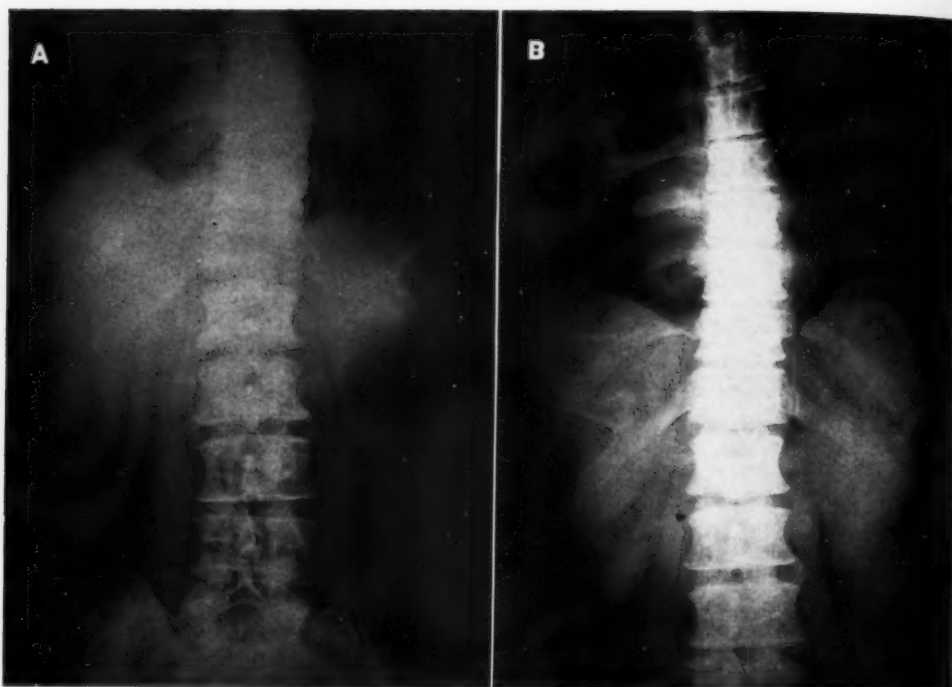


Fig. 2. Case I. A. Extensive metastases to the entire spine. B. The same case one year after orchiectomy, showing normal appearance of the spine.

hormone, exactly the reverse effect occurred.

Because of the paucity of material in the literature, it appeared worth while to present two additional cases of cancer of the male breast in which orchiectomy has been performed, since these may help to throw further light on the subject.

CASE I: J. C., male, age 68, noticed, in the fall of 1933, a small flat growth under the right nipple. On Sept. 24, 1934, a radical amputation of the right breast was performed. The microscopic report was advanced scirrhous carcinoma of the breast with involvement of the axillary lymph nodes. The wound healed rather slowly. From December 1934 to April 1935, three series of deep roentgen therapy were given with 200 kv., 1 mm. Cu. The entire right anterior thoracic wall, axilla, supraclavicular and infraclavicular fossae were included, and doses of 110, 100, and 90 per cent SUD were administered in the successive series.<sup>2</sup> Repeated periodical check-up

examinations from April 1935 to June 1937 remained negative for evidence of recurrence or metastases.

On June 28, 1937, the patient returned with a recurrent nodule in the axilla near the anterior fold. This nodule was about 2 cm. in diameter. It was excised immediately under local anesthesia. The microscopic report at this time was cylindrical-cell carcinoma. From June 30, 1937, to Dec. 30, 1937, the patient received three additional series of deep roentgen therapy. The procedure was identical with that used formerly. Further periodic check-up examinations continued to give negative results until the summer of 1942. At that time the patient began to experience severe pain in the back and lost weight rapidly. Roentgenographic study on Oct. 10, 1942, revealed widespread osseous metastases (Figs. 1 and 2), but there was no evidence of local recurrence or visceral metastases.

On Oct. 31, 1942, a bilateral orchiectomy was performed. The microscopic study of the testes showed fibrous atrophy. The patient made an excellent recovery. Within four months, he regained his normal weight and became completely symptom-free so that he was able to return to work. Check-up roentgenograms made Sept. 17, 1943, revealed disappearance of the osseous metastases with good reossification of the formerly destroyed areas (Figs. 1 and 2). At the present, the patient is well and apparently free of carcinoma.

<sup>2</sup> One hundred per cent SUD represents 900 r (525 r in air) given in one seance on a field 20 X 20 cm. with an intensity of 20 r/min., if the quality of the roentgen rays is that obtained with 200 kv. equiv. (1 mm. Cu); and 1,100 r (800 r in air) if the quality is that obtained with 500 kv. equiv. (7 mm. Cu).





Fig. 3. Case II. A. Recurrent cancer en cuirasse in a case of a primary carcinoma of the male breast. B. The same case four months after orchiectomy, showing definite improvement. Following this, generalized metastasis developed, with death about four months later.

CASE II: W. F. K., male, age 67, noticed progressive enlargement of the left breast in November 1942. At the end of December 1942, a local mastectomy was performed. The microscopic study revealed a highly malignant medullary carcinoma with many hyperchromatic giant cells. On Jan. 11, 1943, the patient was referred for radiation therapy, to be followed by radical mastectomy in six to eight weeks. From Jan. 15 to Jan. 19, a full series of deep roentgen therapy was given with 200 kv., 1 mm. Cu. Attention was directed to the entire left anterior thorax, axilla, supraclavicular, infraclavicular, and cervical regions. A dose of 110 per cent SUD was given. On March 15, 1943, a radical mastectomy was performed. The microscopic analysis at that time showed nothing to reveal the nature of the original process.

From March 22 to August 26, 1943, the patient received 3 additional series of deep roentgen therapy with large doses, the technic of procedure being identical with that of the first series. On Jan. 10, 1944, he returned with a recurrence in the site of the mid-scar, giving the appearance of cancer en cuirasse (Fig. 3). There was also evidence of beginning metastases in the liver. The patient was losing weight rapidly.

On Jan. 24, 1944, a bilateral orchiectomy was performed. For four months there was definite improvement, with a gain of 20 lb. in weight and regression of the cancer (Fig. 3). In May 1944, the local recurrence again became active, and generalized visceral metastases rapidly developed. On August 23, 1944, the patient died.

#### DISCUSSION

Although two cases are insufficient to permit any definite conclusions, individually they can well be placed in similar groups observed in female breast cancer, where our knowledge is more complete. In the first case, after a period of about nine years, during which the primary growth and the regional lymph node metastases were completely brought under control by a combination of radical surgery and intensive radiation therapy, widespread metastases developed in the skeleton. Bilateral orchiectomy was performed in October 1942, merely as a last gesture in a hopeless situation. Within a few months there was a dramatic response. The severe pain completely disappeared and the patient regained his normal health. Roentgenograms revealed disappearance of the osseous metastases and showed compact reossification within the areas formerly destroyed. At present, nearly two years later, the patient is in good condition and the carcinoma still appears well controlled. This behavior, although unusual for such extensive carcinomas of the male breast, is

encountered not altogether infrequently in osseous metastases of the female breast following roentgen castration associated with other methods of treatment. Experience with a large number of cases at Harper Hospital shows that a symptom-free survival of three to four years, if no other vital viscera are involved, is common, and that individual patients have lived as long as ten years, although marked generalization of the osseous metastases existed from the beginning.

In the presence of local recurrences or visceral metastases of mammary carcinoma, the results were not as satisfactory. In the second case, the progress of the carcinoma as a whole was much more rapid than in the first, indicating a considerably higher malignancy index. Within a short time following radical surgery and very intensive irradiation, local recurrence developed in the form of cancer en cuirasse and there was evidence of beginning distant visceral metastases but no involvement of the osseous system. Here, too, following orchiectomy there was a definite initial response, with great improvement generally and a 20 lb. weight gain. The local recurrence regressed to about half its original size. Soon, however, the metastases in the viscera, especially the liver, got out of control, and the patient died nearly eight months later. Thus, the response to castration in this case conformed very much to that observed in similar instances of female breast cancer.

The reason why osseous metastases from mammary carcinoma of both sexes respond more readily than local recurrences or visceral metastases to the castration treatment, particularly in appropriate association with other methods of therapy, is not clear. It is possible that a neoplasm which, despite everything, produces local recurrence or swiftly invades distant viscera represents a cancer of extremely great activity from the beginning and that thus the removal of the estrogen source would have little or no influence on it. On the other hand, metastases to the osseous system are known to occur at a some-

what later period (in the first case nearly ten years after the onset of the carcinoma), suggesting a slower rate of growth of the cancer. Moreover, the osseous system itself does not possess a function as vital for the survival of the body as, for example, the liver, brain, and most other viscera, a fact which, in the end, results in an apparently additional prolongation of life. This view is supported by the long clinical experience in connection with breast cancer in the female. Despite some very spectacular initial results, a reactivation of the osseous metastases occurs sooner or later, and there is not a single case on record in which castration has produced a permanent control of the secondary bone lesions in carcinoma of the female breast. The good result in our first case of carcinoma of the male breast is only of about two years' duration, so that observation must be continued for several years before a final conclusion can be drawn.

Perhaps one should also mention the fact that recent experiments by Woolley, Fekete, and Little (4) have demonstrated that the removal of the gonads in either the male or the female mouse was followed by changes characteristic of feminization. That the stimulation was female-like rather than male-like after castration was evidenced by the lack of development of the accessory sex glands and the growth of the mammary glands. A nodular hyperplasia of the adrenal cortex was observed regularly and it is probable, therefore, that this became the source of the feminizing influence, especially since the adrenal changes have always preceded feminization. This observation is interesting, since it may help to explain why the administration of a male hormone (testosterone propionate) produces aggravation of the osseous metastases in mammary cancer of both sexes, as described by Farrow and Woodard (3), and why castration has the opposite effect.

#### SUMMARY AND CONCLUSIONS

Two cases of carcinoma of the male breast are presented in which, at a very

advanced stage, orchiectomy was performed as a therapeutic measure.

In the first case, the onset of the carcinoma dated back to 1933. Radical mastectomy and repeated series of deep roentgen therapy led to a satisfactory result until the summer of 1942, when general osseous metastases developed. In October 1942, a bilateral orchiectomy was done. Within a few weeks, there was a spectacular improvement, and the metastases completely disappeared in a period of a few months. At the present time, nearly two years later, the patient is in good condition and apparently free of carcinoma.

In the second case, the onset of the carcinoma was in the late fall of 1942. A radical mastectomy followed by four series of deep roentgen therapy failed to prevent the development of local recurrence, which assumed the character of cancer en cuirasse. There were also signs of beginning metastases in the liver but there was no invasion of the osseous system. In January 1944, a bilateral orchiectomy was done. Here, too, there was a very remarkable improvement, with a 20 lb. weight gain within a few months after the operation. In June 1944, however, extensive local recurrence developed, as well as widespread visceral metastases and at the end of August 1944, the patient expired.

The two cases are interesting since they

prove that osseous metastases can be brought under control by castration in mammary cancer of the male, whereas local recurrences and visceral metastases are influenced little or not at all. This observation conforms with the experience gained in mammary cancer of the female in a larger number of cases and over a longer period of time.

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#### DISCUSSION

**Frederick W. O'Brien, M.D.** (Boston, Mass.): I think we recognize that the effects of castration, whether chemical or surgical, whether in the male or female, are equivocal, and that in control of cancer and its metastases, some other factor or factors than control of hormonal secretion must be discovered and fitted into the picture puzzle before our results can be accurately predicted.



## The Problem of Secondary Infection

### in Carcinoma of the Cervix<sup>1</sup>

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**F**EBRILE REACTIONS are a familiar feature of the clinical course in cases of carcinoma of the cervix. They are due to the bacterial infection associated with the tumor and not to the absorption of toxic products from the neoplasm. The virulence of existing organisms may be enhanced by treatment and give rise to alarming septic states that terminate fatally in a small number of the cases. The proportion of deaths occurring immediately, however, gives a misleading idea of the true influence of infection on the management of the disease and on the outlook for the patients who manifest pyrexia of lesser gravity. The present study was undertaken to determine the incidence and severity of infection in a series of cases treated at the Charity Hospital of Louisiana at New Orleans, in an attempt to assess the effect on the immediate and late end-results of treatment.

Much work has been done on the bacterial flora of the cervical tumor. In Laborde's clinic, aerobic streptococci and staphylococci were demonstrated in over 90 per cent of the cases examined, while streptococci were found in more than half of the anaerobic cultures and *Cl. perfringens* in more than one-fourth. Anaerobic streptococci were the organisms most frequently isolated by Von Haam and Connell in an unpublished study conducted at the Charity Hospital Tumor Clinic in 1934. Brunner found that anaerobic cultures were needed in some instances to detect the presence of virulent organisms, but doubted that the hemolytic streptococcus found in anaerobic culture is always pathogenic. Van Damme, who recovered streptococci either in pure or mixed culture in 74 per

cent of his cases, also pointed out that the hemolyzing property is not correlated with the virulence, which he believes is dependent on host resistance. The importance of the streptococcus is emphasized by the work of the German gynecological clinics, where striking differences in the operative mortality have been observed, depending on the presence or the absence of the organism. Heimann found that the parametria were almost regularly infected with bacteria in ulcerating cases of cervical cancer and not infrequently in non-ulcerating cases. Of 65 cases in which the parametrium was cultured, 36 showed streptococci; he feels that this is responsible for postoperative peritonitis. Ducuing has shown that pus from pelvic abscesses contains the same bacteria that could be cultured from the cervix. For these reasons Regaud feels that bacteriological examinations should be done in every case and that no treatment should be undertaken if streptococci can be demonstrated. Hurdon is not impressed with this need. At Charity Hospital the procedure is not performed routinely.

The material for the present analysis consists of 449 previously untreated cases of carcinoma of the cervix seen at Charity Hospital in the three-year period ending March 31, 1941. All cases with adequate histologic proof are included, even though untreated, to permit the estimation of absolute rates. Attention is restricted to the inflammatory complications of the disease at the time of the initial attempt to control it, or appearing as immediate sequels. Late manifestations incident to recurrence or secondary to radiation injuries will not be considered.

<sup>1</sup> From the Department of Radiology of the Charity Hospital of Louisiana at New Orleans, and the Tulane University of Louisiana School of Medicine. Presented at the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America, Chicago, Ill., Sept. 24-29, 1944.



TABLE I: INFECTIOUS COMPLICATIONS OF CARCINOMA OF THE CERVIX

Pelvic cellulitis.....	87 (19.4%)
Pelvic peritonitis.....	20 (4.5%)
Urinary infection.....	14 (3.1%)
Pyometrium.....	11 (2.7%)
Diffuse peritonitis.....	4 (0.9%)
Pelvic abscess.....	3 (0.7%)
Thrombophlebitis.....	2 (0.4%)
TOTAL.....	141 (31%)

It is impossible to set up rigid criteria for a sharp classification of the cases into infected and uninfected. Some patients showed sporadic elevations of temperature to 101° or more but *tolerated treatment without untoward incident*. Others had fever definitely unrelated to the tumor (transfusion reaction, abscess of the buttock, erysipelas of the groin, bronchiectasis, lobar pneumonia, rheumatic carditis, etc.). Obviously all such cases had to be placed in the uninfected group. On the other hand, we have included in the infected class 141 patients who had repeated elevations of temperature to 101° or more, in most instances with a rapid sedimentation time or leukocytosis, or both, attributable to bacterial infection in the cervical tumor or lesions secondary to it.

Thirty-one per cent of our cases, therefore, showed febrile reactions of consequence. This apparently is not an unduly high percentage. While the incidence of fever in carcinoma of the cervix has been variously estimated as 10 to 78 per cent, the figure we observed approaches the rate most frequently given when the milder elevations of temperature are disregarded. Ducuing found that 46 per cent of 1,200 patients had rectal temperatures above 38° C. during treatment. Using a similar criterion, Goldscheider reported pyrexia in 37.5 per cent of 909 cases treated at the Marie Curie Hospital in London, and cited figures in the same range from other centers.

Serious morbidity from infection shows wider discrepancies. Bowing and Fricke reported only 3.6 per cent, Kessler and Schmidt 10.5 per cent, Ducuing 26.4. At Charity Hospital our figure is 31 per cent. In general the complications observed are as shown in Table I. Since more than one

complication may occur in a patient, either jointly or successively, the cases are grouped only under the most important one.

The largest group, pelvic cellulitis, includes a variety of clinical states difficult to discriminate and ranging in severity between cervical suppuration and frank pelvic peritonitis. Some subside spontaneously, but occasionally chronic sepsis and death result. Fatalities occur more often from the less frequent types of infection listed. Among these, peritonitis takes first rank. Septicemia, so seriously incriminated in the French literature, could be established (terminally) in only one case with urinary infection.

The hospital mortality rates observed in our series appear in Table II and are

TABLE II: PRIMARY MORTALITY IN 449 CASES OF CARCINOMA OF THE CERVIX

	Infected	Uninfected	Total
No. of cases.....	141	308	449
Hospital deaths....	13	6	19
Hospital mortality..	9.2%	2.0%	4.2%
Radium cases.....	72	218	290
Radium deaths....	3	1	4
Radium mortality..	4.2%	0.5%	1.4%

higher than the figures usually given in this country (1 to 2 per cent) as the treatment mortality from radiotherapy in carcinoma of the cervix. The explanation is probably evident in the table. We accept many terminal cases that in other localities would find their way to homes for the incurable. Some of these patients receive little or no treatment but are retained in the hospital during their brief period of survival since they have nowhere else to go. On the other hand, the patients with a better prospect of recovery receive radium therapy and exhibit mortality rates correspondingly lower. In any event, the patients with infection have a much graver immediate prognosis, their mortality rate being four to eight times higher than for the patients free from fever. In our radium cases the discrepancy almost exactly duplicates the figures given by Goldscheider—4.3 per cent mortality among 341 pyrexial cases, 0.3 per cent in 568 afebrile patients.



The unfavorable influence of infection is even more clearly shown in necropsy studies. According to Pearson, sepsis, principally peritonitis, is the cause of death in 23 per cent of the cases; only uremia (33 per cent) exceeds this proportion. It follows that, next to renal failure, sepsis is the most important lethal factor. Pearson and one of us subsequently collected an autopsy series of 74 cases of carcinoma of the cervix from the records of Charity Hospital for the period 1930-41. The inflammatory lesions found are listed in Table III and show

TABLE III: INFLAMMATORY LESIONS IN 74 AUTOPSIES FOR CARCINOMA OF THE CERVIX

Peritonitis.....	12 (16%)
Pyometrium.....	8 (11%)
Pyelonephritis.....	11 (15%)
Pyonephrosis.....	6 (8%)
TOTAL.....	37 (50%)

incidence rates practically identical with the figures obtained by Pearson in his earlier study. It is apparent that a grave inflammatory lesion is present either in the urinary tract, the peritoneum, or the genital organs in one-half of the cases examined postmortem.

It seems worth while to stress that, whatever the influence of treatment may be, more than 40 per cent of the complications encountered in this series, from the mildest to the gravest, occurred before any treatment was instituted, as can be seen in Table IV.

TABLE IV: ONSET OF INFECTIOUS COMPLICATIONS IN CARCINOMA OF THE CERVIX

Before treatment.....	58 (12.9%)
During x-ray therapy.....	27 (6.0%)
During radium therapy.....	49 (10.9%)
Post radium.....	7 (1.5%)

All the tabulated urinary complications were present prior to the administration of radiation. They form an integral part of the evolution of the neoplasm, since the essential factor in the development of infection is urinary stasis resulting from ureteral obstruction due to tumor infiltration of the parametria. The lesions in the urinary tract included pyelitis, pyelonephritis, and pyonephrosis, proved by cystoscopy, pyelography, and urinalysis. The respon-

TABLE V: INFECTION MORBIDITY IN 449 CASES OF CARCINOMA OF THE CERVIX

	No. of Cases	Incidence of Infection
All cases.....	449	31%
White.....	151	28%
Colored.....	298	33%
Stage I.....	35	20%
Stage II.....	132	32%
Stage III.....	219	30%
Stage IV.....	63	41%

sible organism was cultured in only two cases: *Escherichia coli* in one instance, *Staphylococcus aureus* in the other, the latter producing death by septicemia. An illustrative case history is appended (Case 1), typifying the fulminating character of some of these infections. Radium therapy was possible in two patients. They have remained well to date, but the median survival period for the group is only two months.

Pyometra was discovered on admission or following x-ray therapy in 9 cases and following radium therapy in 4. The total incidence, 2.9 per cent, is nearly equal to the figure given by Maliphant, 3.08 per cent, and by Healy and Frazell, 3.08 per cent. This is, however, considerably less than in the experience of European clinics. Hurdon, for instance, reported an incidence of 11.4 per cent. Uterine retroversion and cervical obstruction by tumor or by radiation changes have been held responsible for this complication. Six of our 9 patients with pyometra prior to radium therapy tolerated the treatment well; this is the rule, but occasionally the infection spreads and the possibility of controlling the neoplasm is lost. An example of this problem appears below (Case 2). The median survival period for the group was twenty-one months.

In an effort to determine the factors that might predispose to the development of infectious complications, we have recorded in Table V the morbidity in certain subgroups of the series. Contrary to clinical impression, we find that the incidence of infection is not significantly higher in the colored race. The table suggests that the more advanced lesions are infected more frequently, although the incidence gradient

is not so sharp as in the reports of Goldscheider and others. Van Damme believes the clinical extent of the carcinoma does not parallel the degree of infection, and Brunner has shown that the number and virulence of the organisms have little or no relation to the stage of the disease. It is most probable that while febrile reactions are more frequent in the advanced stages, fatal infection can occur in early lesions. Ducuing pointed out that fungating tumors are more likely to be infected.

The age distribution in the infected and uninfected groups is shown in Figure 1. It is clearly indicated that the infected patients are concentrated in the younger age groups. Colored women are known to develop carcinoma of the cervix at an earlier age, their average age in our series being four years less than the average age for the white patients. However, their presence in the series does not account for the downward shift in the distribution, since analysis of the white patients shows that those with infection are six years younger on the average than those without febrile reactions. This is in agreement with Laborde's observation that women less than forty are especially prone to have streptococcal infection. Ducuing, also, pointed out that young women are more susceptible to infection. The mean age for our infected group is  $43.9 \pm 11.6$  years, while the mean age for the uninfected group is  $49.8 \pm 11.5$  years. Testing the difference in the means by Student's distribution,  $t = 5.01$ ,  $P < 0.1$  per cent. We are justified in concluding that the average age is significantly lower in infected cases or, conversely, that sepsis occurs frequently in younger women from a true predisposition and not haphazardly.

Case 3, recorded below, is an example of severe pelvic cellulitis developing as a consequence of the repeated vaginal packing required to arrest severe bleeding. We had 8 such cases, with a median survival period of three months. Severe hemorrhage must therefore be considered a predisposing factor, although, of course, the packing must be implicated, since Phillipp has trans-

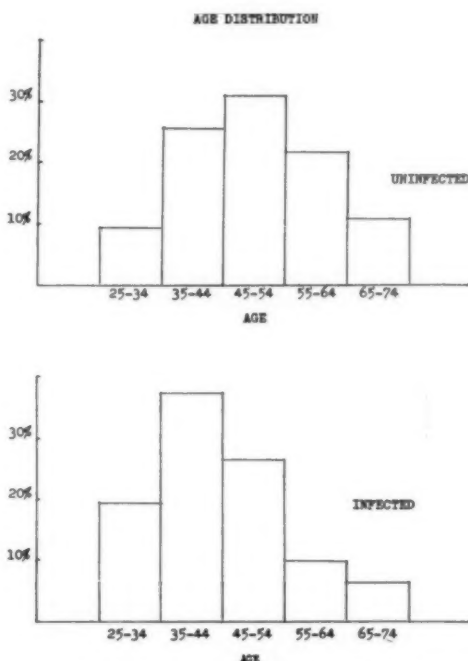


Fig. 1. Carcinoma of the cervix: age distribution of uninfected and infected cases.

formed banal streptococci into pathogenic organisms by tamponage.

Cases 4 and 5 illustrate the tendency to the development of infection manifested by patients in whom the carcinoma is complicated by pregnancy, the puerperium, or lactation. We had 11 such cases altogether and in 9 there were serious septic complications. The cases alluded to also demonstrate the occurrence of thrombosis in the deep pelvic veins (although we have proof only in Case 5). According to Collins and his staff, who have studied the question extensively in this hospital, this complication must occur more frequently than is usually reported (Nelson, Jones, and Collins). Ducuing was of the same opinion and reported thrombophlebitis in 5 per cent of his private cases; in the majority, however, the thrombus occurred in the femoral vein, which was also the site of the lesion in the two cases appearing in Table I.

The interrelations of radiation and infection are complex and remain incompletely

TABLE VI: THREE-YEAR END-RESULTS IN 449 CASES OF CARCINOMA OF THE CERVIX

Stage	I	II	III	IV	Total
<b>Infected</b>					
No. of cases.....	7	41	67	26	141
Three-year survival rate.....	57%	32%	22%	4%	23%
<b>Uninfected</b>					
No. of cases.....	28	91	152	37	308
Three-year survival rate.....	82%	68%	34%	5%	44%

understood. Regaud held that radiation aggravates infection by enfeebling the tissue defenses and creating a favorable terrain for bacterial proliferation. In what may seem a direct contradiction, the administration of external x-ray therapy has been recommended as an effective method of clearing up infection by Coutard, Ernst, Healy, Hurdon, Martin, and others. Van Damme, den Hoed, and Laborde employ small doses of radium for the same purpose. den Hoed has demonstrated the beneficial effects of this method with the aid of the Ruge-Phillipp virulence test. Other investigations with bacteriologic control have failed to yield consistent results. Furthermore, x-ray therapy is known to produce acute febrile reactions causing the cessation of treatment in 4 to 10 per cent of the cases (Ducuing). At Charity Hospital, treatment has almost invariably been begun with external x-ray therapy, and during its administration pelvic cellulitis developed in 11 and pelvic peritonitis in 3 of our patients. There were no hospital deaths in this group, and the median survival period was twenty-two months.

In 69 of our cases infection was considered too severe for us to attempt radium therapy. Pervaginal x-ray therapy proved successful in some of these cases, but the group is too small to permit worth-while comparisons. The radium technic employed is a modification of the Paris method and consists of two fifty-hour applications separated by an interval of twenty-four hours. Despite preliminary x-ray therapy, local disinfection, and a careful aseptic technic, infectious complications occurred in one-fifth of the 290 cases selected for radium therapy. The immediate mortality

is shown in Table II. The more severe reactions encountered are illustrated by Cases 5 and 6.

The remote effects of infection are apparent in the survival curves of Figure 2 and in the end-results shown in Table VI. For comparative purposes of this sort, the three-year rates given are probably satisfactory, especially in view of the fact that the findings are consistent with the five-year rates presented by Goldscheider. In both series the survival rates are significantly lower in the cases with febrile reactions.

TABLE VII: INFLUENCE OF COMPLETENESS OF TREATMENT IN CARCINOMA OF CERVIX

	Complete Treatment	Incomplete Treatment
<b>Infected</b>		
No. of cases.....	53	88
Three-year survival rate.....	47%	7%
<b>Uninfected</b>		
No. of cases.....	218	90
Three-year survival rate.....	58%	12%

In Table VII a comparison of the cases with regard to the completeness of treatment discloses no significant difference between groups similarly treated, and we are led to conclude that the inferior results in the entire class of infected cases is due to inadequacy of treatment and not to inherent radioresistance. This suggests that, with effective methods of controlling infection, full treatment could be given to every case and the salvage for the entire material would thereby be substantially improved. A similar analysis of the cases reported by Goldscheider, however, fails to confirm these views. She finds discrepancies of the order noted before, even when only cases fully treated are compared—52 per cent five-year survival rate for the apyrexial cases, 14 per cent for the infected. The apparent contradictions in the two series could probably be reconciled only by determination of the actual tissue doses delivered, giving due consideration to the time required for the administration of treatment.

Prophylaxis of the infectious complica-

tions of radium therapy by the methods usually recommended has proved ineffectual in a substantial proportion of the cases, as indicated above. Since the temperature and the leukocyte count may be normal in patients harboring virulent organisms, an effort has been made to detect latent infection by other means. With this end in view, the blood sedimentation time has been determined in our cases, by the method of Linzenmeier (see Ponder). Interpretation of the readings is complicated by the effects of anemia, of x-ray therapy (Dunlap), and of the carcinoma itself. The average of the readings among

racy, and probably merits greater attention than is accorded to it in this country.

Once severe infection is established, surgical drainage of pus collections and chemotherapy seem to be the only efficacious methods of treatment. Vaccines, antisera, and other measures have been shown to lack merit in spite of the initial enthusiasm expressed (Mutermilch and Lavedan). The sulfonamide drugs have been tested, and many successes have been reported. We have had failures, but there is no doubt that the drugs can produce an almost miraculous recovery in desperately ill patients (see, for example, Case 6).

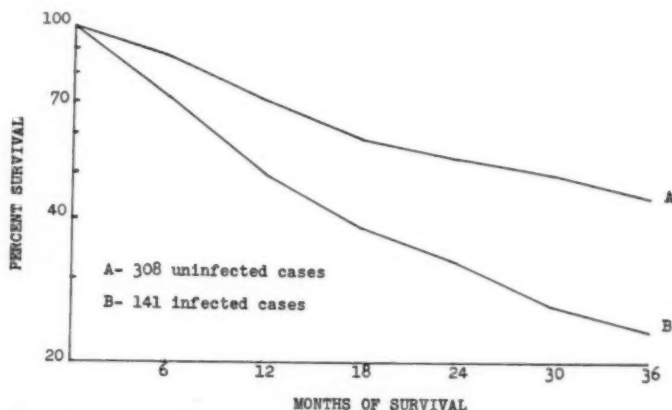


Fig. 2. Carcinoma of the cervix: survival curves for uninfected and infected cases.

the patients who tolerated radium well was 52.5 minutes; among those with interruptions of the radium therapy, 36.5 minutes; among those in whom no radium therapy was attempted, 25.9 minutes. These values clearly reflect the severity of infection in the groups as a whole. Unfortunately the determinations in the individual case are subject to fluctuations that prevent the recognition of any clear lines of demarcation, so that the test has only a limited value for our purposes. We have had no experience with the Ruge-Phillipp test, but it would seem from the evidence furnished by Phillippp himself, Clauberg, and others, that it can be relied on to foretell the possibility of serious complications in individual cases with a fair degree of accu-

Penicillin became available to us in the spring of 1944, and it was decided to use it in cases with infectious complications meeting the criteria specified in a previous paragraph. Twenty cases have been treated with the drug. They represent the infected material among 69 consecutive admissions from Feb. 24, 1944, to July 1, 1944, an incidence of infection of 29 per cent. None of the cases treated had bacteriological control, the degree of infection being assessed on the basis of the temperature curve.

Eleven patients had fever prior to the institution of radium therapy. The previous policy for handling the problem was to give the patients x-ray therapy if possible and, if the infection failed to clear up,



to allow an additional cooling-off period of four weeks or more. In the 11 cases mentioned, penicillin was given at once and radium therapy was completed while the drug was being administered. All of the patients tolerated treatment without incident. A sample case history is given below (Case 7).

Six other patients had pelvic cellulitis or peritonitis precipitated by the application of radium. In 3 the penicillin was given as soon as the infection developed, while in the other 3 it was started after a cooling-off period had failed to bring about improvement. In all 6 cases the drug controlled the infection, so that it became possible to administer the supplementary radium therapy required almost immediately. An illustrative case history is appended (Case 8).

The remaining 3 patients had completed their radiation therapy and had been kept in the hospital because of pelvic cellulitis associated with uncontrolled carcinoma. Two of these patients also had urinary tract infection and in both instances penicillin failed to produce any improvement (see Case 9).

After a period of trial, it was found that satisfactory results can be obtained when the drug is administered intramuscularly every three hours at the rate of 200,000 Oxford units a day. No significant toxic reactions were encountered. Although our experience with the drug is limited, we are convinced that penicillin is an important additional weapon in combating the infection associated with carcinoma of the cervix.

#### SUMMARY

The morbidity and mortality from infection are analyzed in a group of 449 cases of carcinoma of the cervix treated at the Charity Hospital at New Orleans in the three-year period ending March 31, 1941. The infectious complications and their predisposing factors are discussed and the influence of infection on the plan of treatment and on the three-year end-results is considered. Experience with penicillin therapy in 20 more recent cases is reported.

#### CASE REPORTS

CASE 1: C. J., colored, age 54, admitted Jan. 13, 1940, with carcinoma of cervix, stage III. Biopsy: squamous-cell carcinoma, grade III. Temperature normal. Sedimentation time 40 minutes. Urinalysis: 10-15 W.B.C. per H.P.F. Stained urinary sediment: Gram-negative bacilli (not suggestive of *B. coli*) and few short-chain streptococci. Blood urea 14 mg. per cent. P.S.P. 17 per cent. Wassermann reaction strongly positive.

External x-ray therapy was begun on Jan. 17, 1940. Routine cystoscopy, Feb. 2, showed urethral stricture, acute cystitis, and obstruction of the left ureter 2 cm. from the orifice. That night the temperature rose to 102.4°, and the following morning to 104.2°, with severe chill and collapse. The urine was loaded with pus, Gram-negative bacilli, and Gram-positive cocci. X-ray therapy was discontinued. Intravenous fluids and other supportive measures, followed by methenamine, gradually brought the temperature down to 101°. On Feb. 7, the fever again became higher; N.P.N. was 66 mg. per cent; red blood cell count 3,090,000; white cell count 9,900 with 98 per cent neutrophils. Sulfanilamide therapy was instituted, with no improvement. Two days later the blood urea was 107 mg. per cent, creatinine 5.5 mg. per cent. Despite all measures, the patient died with uremia on Feb. 11, 1940. Autopsy showed carcinoma of the cervix with metastases to the periaortic lymph nodes, gangrenous cystitis, acute ascending bilateral pyelonephritis, and left ureteral obstruction.

CASE 2: A. L., colored, age 37, was first seen in the Outpatient Clinic on June 22, 1940, with everted carcinoma of the cervix, stage III, and uterine fibroids. Biopsy: squamous-cell carcinoma. External x-ray therapy was instituted. On July 11, 1940, the patient was admitted to the hospital because of abdominal pain and tenderness and fever. Four days later the temperature rose to 105°, with chilly sensations and abdominal distention; the red blood cell count was 2,260,000, white count 18,450, with 83 per cent neutrophils. Passage of a uterine sound elicited a foul purulent discharge. A diagnosis of pyometrium and pelvic peritonitis was made. Dry heat and supportive measures brought the fever down to 102° in twenty-four hours, but it persisted at 100 to 101.6° for four weeks. Perineal x-ray therapy was given subsequently, but persistence of the pyometrium for four months made radium therapy impossible. The patient died of extension of the carcinoma six months after admission.

CASE 3: M. F., white, age 39, admitted Nov. 8, 1939, with carcinoma of the cervix, stage IV (extension to the labia minora). Biopsy: keratinizing squamous-cell carcinoma. Temperature 99.4°. Hemoglobin 7 gm. (40 per cent). Red blood cells 2,200,000. White blood cells 8,400, with 87 per cent neutrophils. Sedimentation time 50 minutes.



X-ray therapy was instituted on Nov. 13, 1939. Two days later severe hemorrhage occurred and the vagina was packed. The temperature rose to 102.6°. A transfusion was given. The packing was removed in twenty-four hours but had to be reinserted on several occasions. Repeated transfusions were given. The temperature continued between 102 and 104° and death ensued Dec. 2, 1939, from hemorrhage and sepsis. Autopsy showed necrotic carcinoma of the cervix with a small vesicovaginal fistula, secondary anemia, ulcerative cystitis, congenital right double ureter, and bilateral hydronephrosis.

CASE 4: M. B., white, age 37, admitted Oct. 15, 1940, with a friable tumor of the cervix, five-months' pregnancy, and abdominal cramps. Biopsy: squamous-cell carcinoma. Sedimentation time 30 minutes. On the night of admission abortion occurred, with expulsion of a female fetus 22 cm. long. The following day the patient had a severe chill, with fever of 103° and a foul lochial discharge. The hemoglobin was 66 per cent, red blood cell count 4,010,000, white cell count 15,120, with 86 per cent neutrophils. Sulfathiazole therapy was instituted and repeated transfusions were given, but chills and fever of 103 to 105° continued till Oct. 22, when a remission occurred. The patient was then considered too ill for even external x-ray therapy. On Oct. 26, the former course of the illness was resumed, with three or four chills daily, fever of 102 to 105°, vomiting, diarrhea, and abdominal distention and tenderness. On Nov. 7, the patient suddenly became dyspneic and had a circulatory collapse, from which she rallied. X-ray films of the chest were negative until Nov. 14, when they disclosed multiple pulmonary infarcts. Later the liver became enlarged and tender, and jaundice developed, with an icterus index of 50. Metastatic abscesses appeared in the right hand and left preauricular region. Subsequently left supraclavicular adenopathy occurred. Blood cultures were negative on five occasions: blood urea was 24 mg. per cent. Death occurred in coma, with a temperature of 106°, on Nov. 19, 1940. The final diagnosis was carcinoma of the cervix complicated by pregnancy, puerperal sepsis, and peritonitis. We believe the patient had pelvic thrombophlebitis and pyelophlebitis.

CASE 5: A. T., white, age 25, admitted June 1, 1940, with carcinoma of the cervix, stage III, and a history of chills and fever. Biopsy: squamous-cell carcinoma.

The patient had had a sanious vaginal discharge since delivery five months previously. She was still lactating. The hemoglobin was 80 per cent, the sedimentation time 15 minutes. A septic fever continued for four weeks, despite administration of sulfanilamide and sulfapyridine, ranging between 101 and 104°. Chest films were negative, as were blood smears and agglutination tests. There was no pyometrium, no pelvic abscess. On June 29, cystoscopy showed bullous edema of the bladder. The ureters

were not obstructed, but there was slight stasis in both kidneys, with hazy urine. Indigo carmine concentration by the left kidney was impaired. The impression was that the patient had a pyelonephritis. A bilateral pyelogram was negative and a urine culture was sterile.

External x-ray therapy was begun on July 5 and completed four weeks later. There was a transient reduction in fever with irradiation, but the septic course continued and the temperature became normal only a few days before discharge, on Aug. 27.

The patient was readmitted, improved, Sept. 27, 1940. In the interim she had been symptom-free except for a sanguineous vaginal discharge. The temperature was normal, the sedimentation time 30 minutes. On Oct. 4, radium was applied within the uterus and vagina. Eight hours later the temperature rose to 104°, with a chill. The radium was removed, but the temperature continued to rise, reaching 106°. Sulfanilamide therapy was instituted. The hemoglobin was 75 per cent, red blood cell count 4,500,000, white cell count 6,750, with 70 per cent neutrophils. A blood culture was negative. Repeated transfusions were given, and oxygen was administered by catheter. Chills continued, however, with fever of 101 to 104° and, despite all measures, the patient died in stupor, Oct. 11, 1940, with dependent edema, faint icterus, and abdominal distention. Autopsy showed carcinoma of the cervix with endo-, myo-, and parametritis, thrombophlebitis of the uterine and ovarian veins, cystitis, bronchopneumonia, and pyelonephritis.

CASE 6: S. E., white, age 34, admitted Nov. 28, 1939, in shock from vaginal hemorrhage due to fungating carcinoma of the cervix, stage II. After the emergency had been successfully handled, biopsy showed squamous carcinoma of the cervix (transitional type). The Wassermann reaction was strongly positive; temperature normal.

X-ray therapy was administered from Dec. 5 to Dec. 29, 1939. On Jan. 5, 1940, radium was applied for fifty hours, the maximum temperature being 99.6°. On Jan. 8 radium was again applied. Twenty-four hours later the temperature rose to 104°, and the radium was removed. The temperature continued to climb, however, reaching 106° (axillary). The patient had severe chills and became unconscious. Rigorous measures were instituted to combat the fever, including iced alcohol, cold water flushes, infusions, calcium gluconate, adrenalin, caffeine sodiobenzoate, and neoprontosil. Sulfanilamide was given by clysis. The temperature remained elevated, however, oscillating around 105°. The following day stimulants, ouabain, infusions, and sulfanilamide by clysis were continued. The temperature was still high, reaching 104.4°, but the condition of the patient was improved and she responded to questioning. On the fourth day the temperature dropped to 102° and on Jan. 13 it returned to normal. Following the acute attack, speech re-

mained somewhat slurred, but the patient regained strength and was discharged on Jan. 28, with no further irradiation. She left the state two months later without evidence of active disease, but death occurred twenty-five months after her original admission.

CASE 7: T. J., colored, age 32, admitted May 6, 1944, with carcinoma of cervix, stage III. Biopsy (four days after admission): epidermoid carcinoma, grade II. Following biopsy the temperature, previously normal, rose to 100.8°, and fever of 99.2 to 103.4° continued for three days. The hemoglobin was 14.2 gm., red blood cell count 5,200,000, white count 5,200, with 78 per cent neutrophils. Penicillin was given at first intravenously, then intramuscularly. Within two days the patient was afebrile, and on the fifth day radium was applied. Exposure was for fifty hours with a maximum recorded temperature of 100.2°. Penicillin and radium therapy were then discontinued simultaneously after a total dose of 325,000 Oxford units of the drug. External x-ray therapy was given a month later. At its completion, Aug. 7, 1944, the cervix had not healed entirely, but the patient was in excellent condition.

CASE 8: W. B. C., white, age 29, admitted March 31, 1944, with carcinoma of the cervix stage II. Biopsy: keratinizing squamous-cell carcinoma. The cervix showed a ragged central crater and considerable suppuration. X-ray therapy was given in the Outpatient Department from April 3 to May 15. The patient was readmitted on May 16, with little change in the appearance of the cervix. The temperature was normal. On the following day radium was applied in the uterus and vagina. The temperature began to rise that evening and by five o'clock the next morning reached 104.2°. The radium was removed and penicillin was given, for the most part intramuscularly. The temperature fell to 101° the same day and by the third day was normal. Radium was reapplied for fifty hours on May 24 and for thirty hours on May 27. During the second application a transient rise of temperature to 102° occurred. Radium and penicillin were discontinued at the same time on May 28, after administering 1,412,500 Oxford units. After being afebrile for two days, the patient was discharged on May 31. She reported for observation on Aug. 10, 1944, apparently in good health, without evidence of residual disease.

CASE 9: O. G., white, age 34, admitted Feb. 10, 1944, with stage III carcinoma of the cervix. Biopsy: non-keratinizing squamous-cell carcinoma. X-ray therapy to the pelvis was begun but was discontinued when severe jaundice developed, March 16. All diagnostic tests indicated that the jaundice was of obstructive origin. An exploratory laparotomy on March 31 disclosed obstruction of the common bile duct by a group of enlarged lymph nodes. These were removed and were found to represent chronic lymphadenitis. Biliary tract drain-

age was established, and the jaundice rapidly subsided. External x-ray therapy was then resumed, being completed on May 4. Following the completion of x-ray therapy, the patient continued to have fever, which gradually increased until daily temperature elevations of 102 to 103° were occurring. Repeated cystoscopic examinations and pyelograms revealed bilateral pyohydronephrosis. Bilateral nephrostomy was performed, but in spite of adequate drainage, sulfonamides, and urinary antiseptics, the temperature continued to spike to 102° or 103° daily. In an attempt to control the infection, the patient was placed on penicillin, 200,000 Oxford units per twenty-four hours. This was continued for ten days, with a total dose of 1,975,000 units. During the course of administration, the patient's temperature was not affected. It dropped to normal on the day the drug was discontinued, remained normal for five days, but then resumed its former trend. The septic course has continued unaffected by the drug (Aug. 31, 1944).

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## Indications and Limitations of Transvaginal Roentgen Therapy for Cancer of the Cervix<sup>1</sup>

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IF THE RAYS we use to destroy cancer cells, or to inhibit their growth, were harmless to all other cells, the solution of the problem of how to cure cancer of the cervix would be easy. We could deliver to every part of the pelvis a lethal cancer dose of roentgen rays, which is now considered to be about 6,000 r. But x-rays are not innocuous, and if we tried to administer, in a short time, such an enormous dose to such a large area, few of our patients would recover. We must compromise between the ideal and the practical. In this country, it is now pretty generally agreed that the best plan of attack on cervical cancer is to administer to the primary tumor, in and around the cervix, a destructive dose, or as nearly a destructive dose as we dare to give. This is supplemented by a smaller dose to the entire pelvis, which we believe, or at least hope, is large enough to inhibit the growth of cancer cells.

The most commonly employed method of destroying the primary tumor is to use tubes of heavily filtered radium in colpostats in the lateral vaginal fornices, in combination with an intra-uterine tandem. Although gamma rays have great penetrative power, radium must be placed so close to the tissues to be treated that its action is uneven. With the best possible technic, not more than 30 per cent of the surface dose reaches a depth of 3 cm. (1). This means that, if we deliver a destructive dose to the third centimeter of tissue, the first centimeter receives more than three such doses.

The Chaoul technic is also used to deliver a destructive dose of roentgen rays to the cervix. The tube itself is inserted into the vagina and, with good technic (100 kv. and 5 cm. A.S.D.), the distribution of the

radiation is about the same as with good radium technic, but no better. About 28 per cent of the surface dose reaches a depth of 3 cm. (2).

The transvaginal method of direct roentgenization of the cervix, introduced by Merritt (3, 4), in what I believe to be the most valuable contribution to radiotherapy since the adoption of the international unit, is by far the most efficient method of destroying the primary tumor. The principal objection to it is the difficulty of exposing a field large enough to include the entire lesion and the lateral fornices. Incidentally, this is a good place to say that the treatment of cervical cancer through radioopaque cylindrical specula, exposing a single field smaller than the lesion, is hopelessly inadequate and should be abandoned. Merritt exposes a large field by using a speculum transparent to the rays, allowing the expanding beam to pass through a part of the vagina. Wasson and Bouslog (5) do it by using multiple overlapping fields, and we do it by retracting the vaginal walls (6, 7, 8).

In our modification of the transvaginal method of irradiation, the following physical factors are employed: kv. 200; ma. 20; A.S.D. 25 cm.; effective filter, Cu 0.75 mm.; hardness expressed as half-value layer in copper, 0.9 mm. The short distance is used to take advantage of the rapidly expanding beam, to shorten the time of the treatments, and to lessen the danger of overexposing the rectum. We can usually expose an oblong field  $5 \times 6.5$  cm., or two half-oval fields which, combined, measure  $5 \times 7$  cm. Seventy per cent of the surface dose reaches a depth of 3 cm. Our measurements also show that the depth-dose percentage at 3 cm. is 58

<sup>1</sup> Presented at the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America, Chicago, Ill, Sept. 24-29, 1944.



with the following factors: kv. 135; ma. 5; A.S.D. 25 cm.; filter, Cu 0.25 cm.; hardness, expressed as half-value layer in aluminum, 8.0 mm. Braestrup's (9) recent study of the distribution of similar rays shows that the percentage of the surface dose reaching the third centimeter is 59 at 20 cm. A.S.D. and 64 at 30 cm. A.S.D. His findings agree with those of other accurate investigators (10, 11, 12).

This all means that there can be no doubt that, using at least 135 kv., and copper filters at least 0.25 mm. thick, we can, if we choose, deliver an aggregate dose of 6,000 r to the tissues at a depth of 3 cm. without producing necrosis of the surface of the cervix. Such an accomplishment is impossible by any other known method. With such dosage and distribution, we should expect to get improved clinical results, and we do. I believe that all those who have used the transvaginal method will agree that their results justify a definite statement that the method is indicated in every case in which it can possibly be used.

There are several objections, limitations, and contraindications to transvaginal therapy, the most frequent being that suitable apparatus is not available. It is true that few 200-kv. tube stands are designed to be used at short distances, but most of them can be modified. If they cannot be so modified, we all have, or should have, 135-kv. shock-proof therapy apparatus which will produce a beam of rays with much better distribution, as I have already pointed out, than the best radium or the best Chaoul technic. Any mechanic can make in a few hours a simple speculum such as the half-oval instrument which we sometimes use, so that the problem of obtaining suitable apparatus is not insurmountable.

Vaginal atresia is, of course, a definite contraindication to the use of the method. Vaginismus and the narrowness of the vagina sometimes seen in spinsters and childless women make the introduction and expansion of the speculum painful and sometimes impossible. In such cases, we do not hesitate to give the treatments under nitrous oxide or intravenous anesthesia.

Pelvic infection, and especially retention of pus in the uterus, has long been considered a contraindication to radium therapy. In less degree, it at least postpones transvaginal treatment until the cross-fired series is well under way and the infection has been controlled.

Finally, there is the question of how much we should try to do for advanced, apparently hopeless cases. Unquestionably, many patients with advanced cancer receive satisfactory and sometimes unexpected palliation from roentgen therapy. On the other hand, transvaginal treatment is, at best, an unpleasant procedure. When it appears futile to expect a cure, it is probably good judgment to restrict such treatment to the cases in which response to the cross-fired treatment indicates a radio-sensitive tumor, or to use it for such palliative effect as the control of hemorrhage.

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## DISCUSSION

(Papers by Garcia and Schlosser and by Erskine)

**Edwin C. Ernst, M.D.** (St. Louis, Missouri): Dr. Garcia and Dr. Schlosser are to be complimented for again calling our attention to the septic reaction factors in carcinoma of the cervix. This subject is very timely and vitally important in the interest of improving our present survival rates—this for the reason that occasionally we are forced to modify and perhaps prolong our planned irradiation programs because of these severe reactions and inflammatory complications. Especially is this subject opportune in view of the many new and apparently effective drugs which have been developed during this present decade, for all forms of infection, particularly those forms resistant to early treatment.

I realize that at present the scarcity of some of these drugs is a severe handicap. I know it has been to us. I do not refer to the immediately fatal cases following radium application without preliminary x-ray therapy, which are important, of course, but to those patients presenting minor and major infections, especially of the genito-urinary tract, prior to and during the course of the treatment. Since the advent of preliminary roentgen therapy in our groups and careful medical check-ups, the situation as regards complications, and especially infection factors, has been improved. Nevertheless, there is room for further improvement, and our past experience would warrant the prediction that this will be effected if we are fortunate enough to eliminate most of these apparent febrile reactions following irradiation and necessitating its discontinuance.

I am looking forward to obtaining a generous supply of these drugs, particularly penicillin, which we have employed to some extent in the past. I hope that in the group which the author mentions, patients under forty (they really have been problem children for us), we can better treat carcinoma of the cervix with infection.

We have, of course, all observed that occasionally severe infection of the pelvis, general low-grade infection, and other changes respond almost miraculously to irradiation. At the same time, smaller and apparently less formidable lesions may fail to react. The danger then lies from infection reducing or unnecessarily prolonging the timing of our planned irradiation; what we consider ideal timing for our treatment is changed, thus handicapping our vital cancer problem by inadequate dosage. This may not prove to be the all-important factor, but I personally believe it merits our future attention.

In reference to transvaginal roentgen therapy as discussed by Dr. Erskine, I agree with most of the enthusiastic premises as he presented them in reference to the indications for and limitations of this method. I am sure that we all appreciate the logical necessity and the essential requirement that lethal doses reach the cervix and the surrounding pelvic

structures if treatment is to be effective. That we must occasionally compromise between the practical and ideal, in the interest of the local cervical lesion, is self-evident. Any one of a variety of methods must be selected to meet the needs of the individual case. All in all, direct intravaginal x-ray therapy procedures require a great deal of skill and personal supervision, which is as it should be, no matter which method or methods may be selected.

Technical difficulties in employing the transparent specula first suggested by Merritt and the ingenious multiple ports of Wasson and Bouslog, together with the psychological fact of a reluctance by some of us to abandon the old, orthodox method of direct intracervical radium applications, have perhaps been to a large extent retarding factors, preventing the more universal use of transvaginal therapy. In selected cases I have employed this method with increasing frequency and with good success, although I have been unable to complete comparative studies. Thus far I have conservatively remained reluctant to abandon completely the intracervical and vaginal forms of radium application in stages I, II, and III.

I have been, most naturally, intrigued by the differences in the respective depth doses with direct x-ray therapy and our usual radium application, and I have worried, perhaps unnecessarily, regarding the probably limited effective lateral wall roentgen distribution when the average transparent specula were employed. Apparently the vaginal dilator, as shown by Dr. Erskine, may be the answer to my prayer and will renew my unqualified faith in this method of attacking the cervical cancer problem.

**Chas. L. Martin, M.D.** (Dallas, Texas): There has been very little written on infection in carcinoma of the cervix and I consider the paper by Drs. Garcia and Schlosser one of the best that has come to my attention. It has been my custom to assume the complete care of patients with cervical cancer and in some instances the treatment of the ever present infection becomes more difficult than the treatment of the malignant condition.

In our Clinic, the first step consists in the removal of all presenting tumor tissue, the drainage of the uterine cavity and pockets of pus within the tumor, and the coagulation of all bleeding points under sodium pentothal anesthesia. Before this procedure is carried out, the vagina and the tumor are thoroughly scrubbed with green soap. Although some temperature elevation is likely to follow this cleaning up process, the free use of soap has reduced such reactions to a minimum. The removal of excess tumor tissue enables us accurately to approximate radium applicators to the remaining tumor tissue in a dry field, thereby reducing the necessary total dosage. I note with some satisfaction that the essayists do not advocate the local use of antiseptics or sulfa drugs, since such therapy has not been successful in our hands.

When a temperature elevation appears, with an

elevation of the pulse rate, and an appreciable increase in the white count is accompanied by a shift to the left, one of the complications described by Dr. Garcia has occurred and full doses of sulfathiazole should be started immediately. The prompt institution of this treatment is most important, because it is of little value after abscesses form. Although sulfa drugs have produced very satisfactory results in our Clinic, Dr. Garcia's results indicate that penicillin has many advantages, and I hope I may be able to use it in the future.

Although most radiologists use x-ray therapy first in an effort to clean up infection, our experience parallels that of Dr. Garcia, who has observed an aggravation of febrile reactions during intensive external irradiation, particularly in the neglected case with abscess formation. My chief reason for employing x-ray therapy as a secondary procedure is the difficulty which we have experienced in attempting to place large radium applicators in the fornices after the vaginal contraction following external irradiation has taken place.

Dr. Erskine's ingenuity in perfecting cones for intravaginal therapy deserves the highest commendation. Since I have never used the method, I am really not competent to discuss his paper. In my opinion the procedure has two weaknesses. Reference to a drawing of a sagittal section of the pelvis shows that a speculum inserted into a normal vagina must of necessity point directly at the anterior wall of the rectum. I find it difficult to believe that the rectal mucosa can successfully recover from the dose of 6,000 r delivered to a depth of 3.0 cm. below the surface. Most of us have attempted to work out radium and x-ray technics designed to irradiate efficiently extensions into the broad ligaments and the tissue between the cervix and the bladder. Again, reference to our drawing indicates that the effective beam from the vaginal cone passes well behind these areas. I hope that Dr. Erskine will explain away my theoretical objections to his method.

**Robert E. Fricke, M.D.** (Rochester, Minn.): I wish to discuss the paper of Dr. Garcia and Dr. Schlosser, "The Problem of Infection in Carcinoma of the Cervix." I think the amount of complication encountered depends a great deal on judgment in determining the type of treatment to be given. All radium therapists are burdened with a great many cases in which the condition is in stage IV or stage III; the patients are anemic, in poor general condition, and may complain of urologic difficulties. Often a kidney is not functioning. Then it is best not to attempt a complete course of radiotherapy, even though it would offer the only chance of cure, but to administer limited treatment for palliation, the value of which is not sufficiently stressed.

If a limited course of treatment is given, it is possible to achieve considerable palliation. The radium therapist gets into trouble when he becomes too

enthusiastic and tries to give a complete course to a patient who cannot tolerate it.

The sulfa drugs and penicillin have helped a great deal. In 1943, we treated 148 new patients with cancer of the uterine cervix at the Mayo Clinic, and for the first time in my experience we had no deaths. I know the sulfa drugs and penicillin saved many seriously ill patients.

**Arthur W. Erskine, M.D.** (Closing): In regard to Dr. Martin's question about over-irradiation of the rectum, we find that by prying up on the outer end of the speculum we can introduce it practically parallel with the long axis of the patient, even though she does not have a retroversion. In this way, we can avoid over-irradiation of the rectum. In about 130 or 135 cases we have had only four instances of severe proctitis.

What are we trying to do when we treat cancer of the cervix? There is one thing that we should be sure that we accomplish if we possibly can. We should at least be sure that we destroy the primary lesion. Sometimes when we treat a patient with what we think is Group I or Group II cancer of the cervix, the primary lesion heals, but a few months or a year later the patient dies of a metastasis deep in the pelvis. We comfort ourselves by saying to ourselves that our original classification was wrong; that the patient, when we treated her, already must have had a Group III cancer with distant metastases.

On the other hand, we have patients that we classify as Group III, because of some palpable nodes along the sides of the uterus or because of some fixation of the organ, who nevertheless recover and stay well. Ought we not, in common honesty, when such a thing happens, say, at least to ourselves, that our original classification was wrong and that the patient should have been put into Group I or Group II and that what we felt were inflammatory nodes—nodes due to infection—rather than true metastases?

I doubt very much if we can cure metastatic cancer, and in this connection I would like to read a paragraph from a letter received from Dr. Merritt:

"I have read your paper very carefully and my only suggestion is to place a little more emphasis on the question of curing Stage III and IV, or rather *not* curing such groups. Where glands are palpable I believe they cannot be controlled by radiation any more than cervical lymph nodes in cancer of the lip. Ewing said that the infection accompanying cancer of the cervix was often as serious as the disease itself. The response of infected lymph nodes and induration caused by infection to irradiation is responsible for confusion and mistakes. This is all quite clear if one recalls the experience of Caldwell and Pusey long before the days of deep therapy. Working with gas tubes and little or no filtration, they were amazed at the favorable effects of radiation in cancer of the cervix. They were, of course, treating the infection, not the cancer."

# Roentgen Diagnosis of Knee-Joint Effusion<sup>1</sup>

CAPT. ARNOLD L. BACHMAN, M.C., A.U.S.

IN THE STUDY of the roentgenograms of a large number of patients admitted to the Station Hospital, Miami Beach Training Base (Miami Beach, Florida), for abnormalities of the knee, changes in the soft tissues have been noted which have greatly facilitated the diagnosis of effusion into the knee joint. These findings are re-

Other references to the findings to be described have not been discovered.

A brief description of the pertinent anatomy of the knee with particular reference to its roentgen appearance seems warranted. Figure 1, A, represents a mid-sagittal section through the knee, drawn from Gray (1) and Spalteholz (8). It will

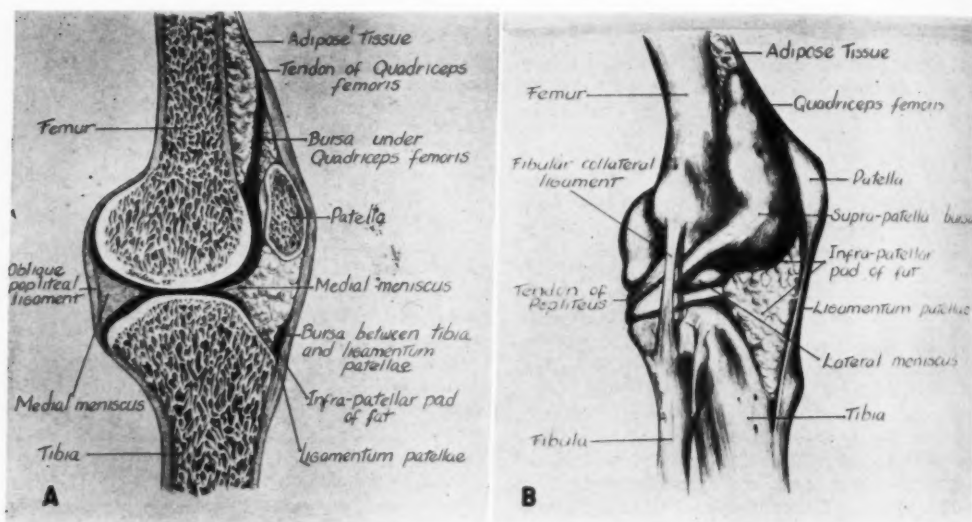


Fig. 1. A. Mid-sagittal section through normal knee joint. B. Appearance of knee joint distended with fluid.

ported since the usually accepted roentgen signs of knee-joint effusion, *i.e.*, anterior displacement of the patella and widening of the joint (3) have been found entirely inadequate in the x-ray diagnosis of this condition.

In a review of the literature, it was found that Lewis (4) mentions the presence of a pyriform mass in the suprapatellar pouch and bulging of the infrapatellar ligament in knee hydrarthroses, but does not describe these abnormalities in detail. Löhr and Hellpap (6) report a fullness in the recess above the upper portion of the knee cap in the presence of intra-articular effusion.

be noted that the cavum articulare lies just behind the infrapatellar fat pad and then proceeds upward behind the patella to connect with the suprapatellar bursa. The synovia forming the base of the suprapatellar bursa lies in a small recess formed by the posterior surface of the upper portion of the patella in front and the femoral condyles behind. For convenience in description, this space will be designated as the patello-condylar recess. The bursa itself is situated just in front of a considerable amount of fatty areolar tissue overlying the lower end of the femur above the condyles. The upper portion of the bursa is covered in front by the tendon of the

<sup>1</sup> Accepted for publication in April 1945.

quadriceps femoris. Inferiorly, just above the superior surface of the patella, in the patello-condylar recess, the base of the bursa is separated from the tendon by a small triangular mass of fatty areolar tissue. Thus, on the lateral roentgenograms an oval area of comparative radiolucency, about 6 to 10 cm. in length, is seen to lie over the anterior surface of the lower end of the femur just behind the density of the quadriceps femoris tendon. This radiolucency extends downward and anteriorly over the dorsal aspect of the condyles,

front from the main portion of the prefemoral fat. The linear bursal opacity then merges with the shadow of the quadriceps tendon and loses its identity, since the bursa and adjacent tendon are of the same radiodensity (Fig. 2). Occasionally, the synovia merges with the adjacent quadriceps tendon immediately above the patella without passing through the fatty tissue. In such cases, no linear or band-like synovial density is seen in the lower portion of the prefemoral fatty tissue and no small triangular area of fatty radiolu-



Fig. 2. Radiographic appearance of normal knee joint. The band-like opacity of the synovia in the patello-condylar recess is clearly demonstrated.

across the upper end of the joint space, and over the superior surface of the patella just behind the insertion of the quadriceps tendon (2). The synovia of the base of the suprapatellar pouch passes upward from behind the patella through the lower portion of the area of fatty radiolucency in the patello-condylar recess and, being more radiopaque than the fat, is usually seen as a linear or thin band-like density, 0.2-1.2 cm. in thickness, which separates the small triangular area of fatty radiolucency in

the joint space from the main mass in the region of the patello-condylar recess (Fig. 3, A). In about 10 per cent of examinations there is no prefemoral fatty areolar tissue present, and the quadriceps tendon lies directly over the anterior margin of the femur. In the latter cases, of course, no area of radiolucency lies between the femur and the quadriceps tendon (Fig. 3, B).

In cases of effusion, the fluid in the knee joint accumulates first and to the greatest





Fig. 3. Normal knee joint. A. Prefemoral fatty tissue extending down to the patella. B. No distinct zone of fatty tissue present over anterior aspect of lower end of femur.

Fig. 4. Case I. E. G., male, aged 40, was admitted May 7, 1943, having fallen on his right knee while walking. Marked soft-tissue swelling, pain, and tenderness over the knee developed immediately. A roentgenogram (A) showed a transverse fracture through the patella and soft-tissue swelling in front of this bone. However, only a slight increase in the width of the soft-tissue opacity lying within the fatty radiolucency of the patello-condylar

[Legend cont. at foot of opposite page]





Fig. 5. Case II. O. R., male, aged 19, entered the hospital with a history of having injured his left knee in 1941, a second time in 1942, and again on the day of admission, April 29, 1943. During exercise the knee had buckled and locked. Swelling appeared immediately. A roentgenogram revealed a pyriform soft-tissue mass in the suprapatellar region and anterior compression of the infrapatellar fat pad. Sixty cubic centimeters of bloody fluid were withdrawn and air was injected. A pneumarthrogram showed that the pyriform shadow of fluid density conformed in size and shape with the air-filled suprapatellar bursa. On June 15, 1943, a medial meniscectomy was performed, during which 30 c.c. of serous fluid were removed from the joint.

extent in the suprapatellar bursa. A lesser amount of fluid is located in the space just below the patella and presses the infrapatellar fat pad forward (Fig. 1, B). The smallest quantity of fluid is situated in the joint space between the femur and tibia. As the bursa expands with the fluid, the line or small band of water density between the main collection of prefemoral fat and the small triangular area of fatty radiolucency in the patello-condylar recess becomes increasingly wide. It represents the fluid-distended base of the suprapatellar bursa (Fig. 6). With further accumulation of fluid, the entire bursa becomes dis-

tended. In about half of the cases it can be completely visualized, since in this group the fluid-filled bursa is surrounded by a thin layer of comparatively radiolucent fatty tissue (Figs. 5 and 9). In other cases the bursa is incompletely bordered by the small rim of fatty tissue and is thus visualized only in part (Fig. 7).

The fluid in the joint just behind the infrapatellar fat pad also distends the synovial space and presses the upper portion of the fat forward. This anterior displacement of the upper part of the infrapatellar fat pad is easily recognized on the roentgenogram (Figs. 5 and 8). Further accu-

recess was observed, indicating a very small amount of fluid. The infrapatellar pad was not compressed. On aspiration, 10 c.c. of blood were removed from the joint space. Open operation was performed the following day and a purse-string wire retention suture applied following reduction. At operation only a small amount of fluid was observed in the knee joint. Re-examination on May 19, 1943, showed the patellar fragments to be in good alignment and considerable diminution of the thickness of the soft-tissue opacity between the patella and femoral condyle.

Final re-examination on July 1, 1943 (B) showed the soft-tissue density of the base of the suprapatellar pouch in the patello-condylar recess to be only slightly wider than normal. On clinical examination, the impression was that of a thickened synovia or plastic intrabursal transudate following the patellar fracture. Aspiration of the infrapatellar and suprapatellar portions of the knee joint failed to reveal any evidence of fluid.



Fig. 6. Case III. J. A. W., male, aged 39, was admitted May 19, 1943, having twisted his knee the previous day. The knee became swollen and tender. X-ray examination on May 20 showed a widened area of fluid radiopacity in the fatty tissue between the upper posterior angle of the patella and the prefemoral fat. The bursa, however, was not clearly delineated. Aspiration of the knee joint resulted in the removal of 60 c.c. of bloody fluid. A pneumarthrogram taken the same day outlined the suprapatellar bursa, which could not be visualized when filled with the fluid alone.

[Legend for Fig. 7 at foot of opposite page]

mulation of fluid in this region pushes the patella itself anteriorly. The weight-bearing portion of the knee joint between the tibia and femur contains a minimal amount of fluid, and widening of the joint is practically never observed except, perhaps, in cases of extreme hydrarthrosis.

Based on the anatomical considerations mentioned above, the following roentgenographic signs have been employed as criteria for the presence of hydrarthrosis in suspected knees:

1. A widened band of fluid density (the distended base of the suprapatellar pouch) in the lower portion of the area of fatty radiolucency between the posterosuperior angle of the patella and the femoral condyle (*i.e.*, the patello-condylar recess).

2. Anterior pressure convexity, mainly of the upper half of the infrapatellar fat pad.

3. Complete or nearly complete delineation of the pyriform fluid-filled suprapatellar bursa (in those cases where the bursae are surrounded by a thin rim of fatty tissue).

4. Anterior displacement of the patella.

5. Widening of the knee joint.

Table I shows the frequency with which the various signs appeared in 20 cases of effusion into the knee joint. In each case, fluid was obtained on aspiration, the amount varying between 20 and 160 c.c. It is apparent that the most reliable sign of effusion is the wide shadow of water density in the area of fatty radiolucency between the upper end of the patella and the femoral condyle, representing the widened fluid-distended base of the suprapatellar bursa. This sign was present in 18 of the 20 cases (90 per cent). In general, the greater the quantity of fluid, the wider was the band-like opacity in the fatty tissue situated in the patello-condylar recess. However, several exceptions to

TABLE I: TWENTY CASES OF KNEE-JOINT EFFUSION

	Width of Soft-Tissue Opacity in Fatty Radiolucency in Patello-Condylar Recess 1.5 cm. or Over	Suprapatellar Bursa Surrounded by Thin Margin of Fat	Anterior Pressure Convexity of Infrapatellar Fat Pad	Anterior Displacement of Patella	Widening of Knee Joint
Definitely positive	18*	5	11	3	0
Highly suggestive	0	4	4	5	0
Slightly suggestive	0	2	0	4	1
Absent	2†	9	5	8	19

\* Width of soft-tissue opacity varied from 1.5 to 5.0 cm. Average 2.4 cm.

† Prefemoral fat not present. No radiolucency observed between lower end of femur and quadriceps femoris tendon.

this generalization were noted. In the two cases where there was no prefemoral fatty tissue (and therefore no radiolucency) differential soft-tissue opacities could not be observed above the patella, since the fluid-filled bursa and the adjacent quadriceps femoris tendon were of the same density. The diagnosis in these cases was founded on anterior pressure convexity of the upper end of the infrapatellar fat pad. Anterior convexity of the infrapatellar fat pad due to pressure was present in 15 (75 per cent) of the cases. A completely visualized, pyriform, fluid-distended bursa was observed in 9 (45 per cent) cases. Evidence to suggest anterior displacement of the patella was seen in 8 (40 per cent) of the roentgenograms. In no case was distinct widening of the knee joint observed. This absence of widening was also noted by Löhr and Hellpap (6) in the twenty-six cases they reported.

Hydrarthrosis must be differentiated from soft-tissue tumors, as synovioma, and from diffuse thickening of the synovia without fluid. The soft-tissue tumors appear as well circumscribed opacities frequently irregular in outline, occasionally containing irregular amorphous calcific

Fig. 7. Case IV. D. F., aged 19, was admitted April 22, 1943, having injured his right knee April 8, 1943. The knee became swollen and tender immediately. Swelling persisted until admission. X-ray examination showed no evidence of fracture. A pyriform shadow of fluid density was partially outlined in the prefemoral region just above the patella. Its appearance was highly suggestive of an opaque suprapatellar bursa. There was a wide band of soft-tissue density in the patello-condylar recess. On aspiration 20 c.c. of bloody fluid were obtained. A pneumarthrogram clearly demonstrated that the pyriform soft-tissue shadow corresponded in size, shape, and position with the air-filled suprapatellar bursa.



Fig. 8. Case V. J. L. W., aged 29, entered the hospital May 10, 1943, several hours after injuring his right knee. The knee had become swollen and tender. X-ray examination showed no evidence of fracture. There was considerable fluid opacity in the fatty tissue between the posterosuperior angle of the patella and the femoral condyle, but the suprapatellar bursa was not clearly delineated. The infrapatellar fat pad was compressed forward. Aspiration yielded 30 c.c. of blood-tinged fluid. A pneumarthrogram taken the same day showed the air-filled suprapatellar bursa.

Fig. 9. Case VI. P. T., aged 30, was admitted June 15, 1943, having injured his left knee two days previously. Swelling and pain had developed immediately and persisted. A roentgenogram showed no evidence of fracture. A small, dense, globular, fluid-filled suprapatellar opacity and anterior compression of the infrapatellar fat pad were clearly delineated. On aspiration, 45 c.c. of straw-colored fluid were withdrawn. A pneumarthrogram clearly demonstrated that the suprapatellar pyriform density conformed with the small air-filled bursa.



deposits. They are situated usually about the joint and show none of the cardinal signs of joint effusion (5, 7). Differentiation between thickening of the synovia or intrabursal exudate without effusion and hydrarthrosis can at times be made only with great difficulty. Three examples of synovial thickening or intrabursal exudate were observed. In the roentgenograms there was a widened band of soft-tissue opacity in the fatty radiolucency of the patello-condylar recess almost identical with that seen in effusion. The width of the band, however, tended to be distinctly less than in the cases with fluid. The remaining signs were not present. It is noteworthy that in none of the three cases was there an anterior pressure convexity of the infrapatellar fat pad. The fat pads, however, were irregular in contour and outline and mottled in appearance.

#### SUMMARY

The roentgen findings in the soft tissues about the knee in cases of knee-joint hydrarthrosis are described. The anatomical

factors in the production of these signs are discussed.

NOTE: I should like to express my appreciation and gratitude to Major O. O. Feaster, Chief of the Roentgenological Service, Station Hospital, Miami Beach, Florida, for his valuable suggestions in the preparation of this article.

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# Extrapleural Pneumothorax in the Treatment of Pulmonary Tuberculosis<sup>1</sup>

Three-Year to Five-Year Follow-Up of 48 Cases

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Oakville, Tenn.

THE USE OF extrapleural pneumothorax is not new in the treatment of pulmonary tuberculosis, but the method of managing and maintaining the collapse thus produced over a sufficient period to allow healing of the diseased lung has been developed over the last five or six years. The operation was first performed by Tuffier in 1891, and he reported, in 1910, that he had been able in three cases to maintain the space over a short period by air refills. The same operation has been done by a small number of operators at intervals since that time, using many substances, including air, to fill the space created, but their results were not encouraging. Paraffin packs attained some success, but erosion into pulmonary tissue, through the chest wall and skin, and gravitation downward in the thorax, have made it, at least, not a very satisfactory form of collapse. In 1936, Graf and Schmidt were successful in maintaining their collapse by frequent refills of air over a sufficient period of time to allow healing of the diseased lung. Following the work of these men, this form of treatment has come into widespread use. Though the last word cannot be said for several years, we feel that the procedure has a definite place in our armamentarium against tuberculosis, based on the encouraging results thus far attained.

## INDICATIONS

The indications for extrapleural pneumothorax are not as yet definitely set forth and vary with different men practising the procedure. We have not used it to replace any of the tried measures, such as phrenic nerve operations, intrapleural pneumo-

thorax, or thoracoplasty, but have offered it to a group of patients who, in our estimation, were not suitable for these procedures, with the hope that, if it were successful, it would either arrest their disease or so improve their condition as to enable them to stand a thoracoplasty. At present we believe that extrapleural pneumothorax is indicated in those cases in which collapse therapy is desirable but intrapleural pneumothorax cannot be established (or is insufficient because of adhesions which cannot be divided) and thoracoplasty is contraindicated by the nature of the lesion or the condition of the patient. In most of our cases bilateral disease or toxicity due to the exudative and destructive character of the lesion has constituted a contraindication to thoracoplasty.

## OPERATIVE TECHNIC

*Preoperative Preparation:* The preparation for extrapleural pneumothorax is the same as for thoracoplasty; the same measures are taken for sputum drainage and the same preoperative medication is given. The majority of the patients are much sicker than are those treated by thoracoplasty.

*Operation:* The patient is placed on the table on his side, as for thoracoplasty, and the head of the table is lowered 15 degrees so as to aid in drainage of secretions during the operation. Nitrous oxide-ether vapor has been used in the majority of the procedures, the others having been done under local novocaine anesthesia. The posterior paravertebral incision has been employed in most cases, with subperiosteal resection of a two- to three-inch segment of the

<sup>1</sup> Read before the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America, Chicago, Ill., Sept. 24-29, 1944.

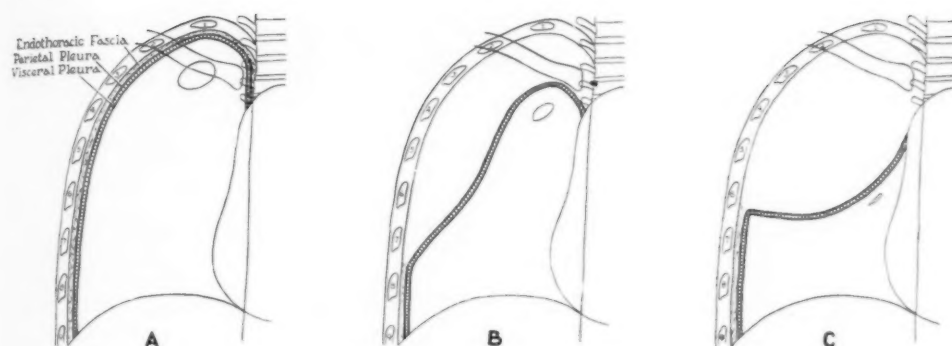


Fig. 1. Extrapleural pneumothorax: diagrammatic illustration of operation. A. Relation of adherent visceral and parietal pleura to the endothoracic fascia. B. Separation in the plane of the endothoracic fascia immediately following operation. C. The extrapleural space several weeks after operation.

fourth rib from the transverse process forward. The plane of the endothoracic fascia is usually easy to locate, and the loose connective-tissue fibers are broken with the finger, allowing the two adherent pleural surfaces and the lung to fall away from the bony thorax and the intercostal muscles. The extrapleural space is developed with the finger until a rib spreader can be introduced and the remainder of the dissection is carried out with gauze-padded instruments under direct vision with the aid of an illuminated retractor. Bleeding is controlled by packing and ligation with silver clips when necessary. It is absolutely essential to keep the line of dissection in the extrapleural space. If this cannot be done, because of dense adhesions and obliteration, the operation must be abandoned before rupture of the pleura takes place.

It is essential that the stripping be adequate at the time of operation, since it is unusual for the extrapleural pocket to be enlarged by air pressure in the following days; more commonly a portion of the pocket is lost in the first few weeks. Extrapleural pneumothorax can be made the most selective of all forms of collapse, but stripping should always be carried down to the hilus on the mediastinal surface and concentrically around the chest wall well below the diseased area. It is possible to strip down to the diaphragm and even from a portion of the diaphragm. When the stripping is completed, the entire

pocket is inspected for bleeding and the wound is closed airtight. During the entire operation 10 per cent glucose is given intravenously. Transfusion has been required in only one of our patients. We have been impressed with the lack of shock and the ability of the patient to recover from the procedure as compared with graded stages of thoracoplasty.

*Postoperative Care and Management:* We feel that the refills and management of the extrapleural space, especially during the first two weeks, determine the success or failure of the procedure. At the end of the operation, the patient is turned on his back and, while he is still on the operating table, a needle is placed in the first or second interspace anteriorly and the pressure brought slightly to the positive side, which usually requires from 150 to 200 c.c. of air. The patient is then moved to the fluoroscopic table and the size of the pocket is observed. Usually a film is made at this time for future reference.

The patient is then put to bed and is turned at three-hour intervals until he is able to turn himself. Small doses of morphine or codeine are usually required for two or three days for discomfort and to control coughing. It is not desirable to abolish the cough, but hard coughing may cause a thin-walled cavity to rupture and always increases the subcutaneous emphysema. Vomiting also increases the amount of air forced out into the tissues. Only those pa-

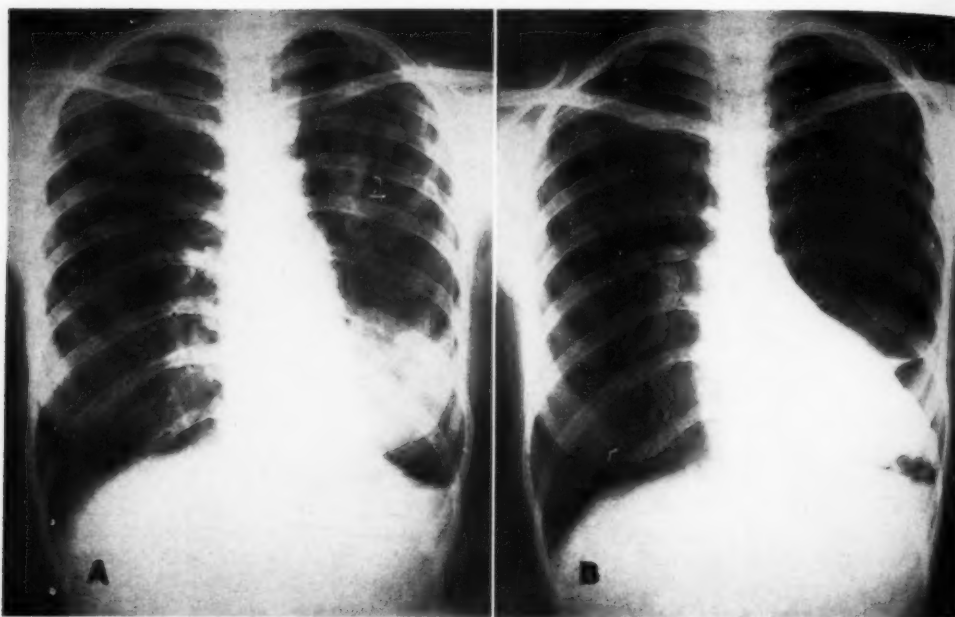


Fig. 2. A. Pneumothorax (right) with large cavity held open by adhesions. Cavity probably of tension variety. B. Same case after operation. Cavity closed; small intrapleural pneumothorax in base.

tients with very low vital capacity have required oxygen.

The patient is examined on the fluoroscopic table at five-hour intervals for the first thirty-six hours and refills are given at these times as often as necessary to maintain the space, the pressure being kept just on the positive side. After this interval, the space usually begins to hold air well, and for the remainder of the first week daily fluoroscopy and refills are sufficient, the lung being gradually collapsed by increasing the pressure. The intervals between fluoroscopy and refilling are then prolonged, a day at a time, as the case permits, usually to as much as a week, and the pressure is brought up to 20 to 30 mm. of water.

In all cases a serohemorrhagic exudate forms, partially filling the space, and this is usually aspirated on the fifth or sixth day, by which time the patient is in most instances able to stand up for fluoroscopy. In a few cases the exudate has been so slight that aspiration was not considered necessary. In other cases two or three as-

pirations have been required. If the space is not dry at the end of three or four weeks, infection, either tuberculous or pyogenic, should be suspected.

#### COMPLICATIONS AND RESULTS

Complications of extrapleural pneumothorax may be divided into immediate and late. The immediate complications may be listed as follows:

1. Rupture into cavities or pulmonary tissue. If this occurs, the operation should be immediately abandoned.
2. Hemorrhage. This should be controlled at the time of operation, and the wound should not be closed until the pocket is dry.
3. Shock. Shock should be treated as in any other operative procedure, first by preventing it.
4. Subcutaneous emphysema. This occurs in moderate degree in all cases if the patient coughs or vomits, but it is not alarming.



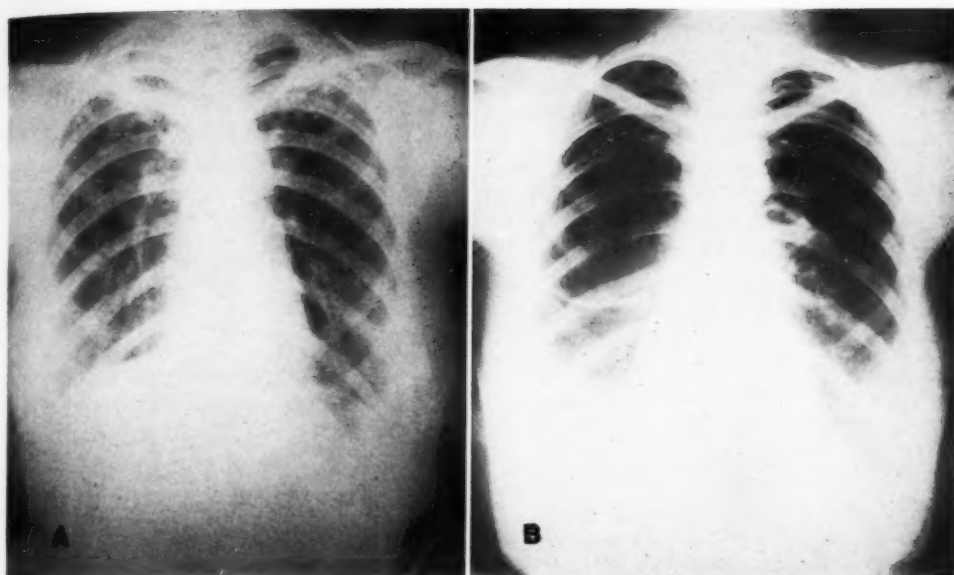


Fig. 3. A. Bilateral disease. Pleura adherent on the right, demonstrated by attempt to establish intrapleural pneumothorax. B. Extrapleural pneumothorax on the right; intrapleural pneumothorax on the left.

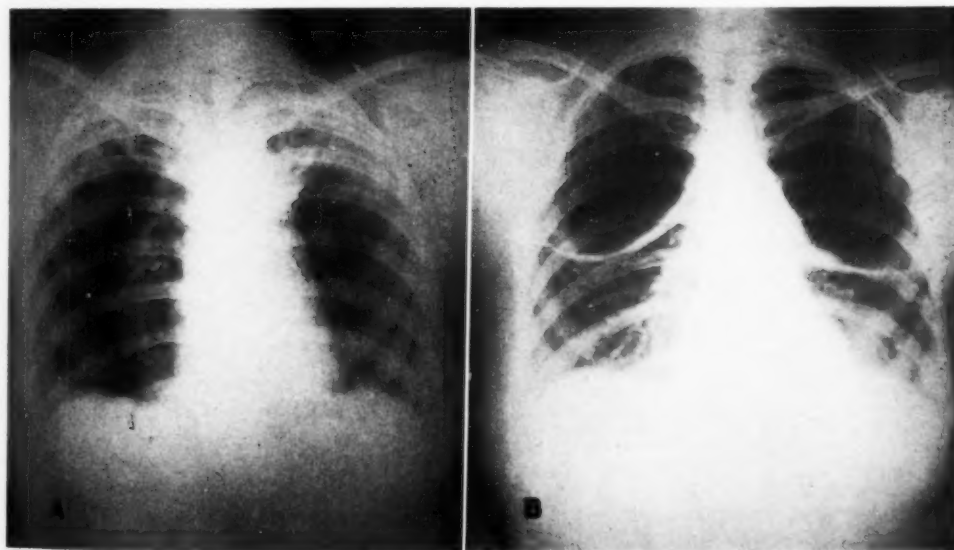


Fig. 4. A. Bilateral disease. Pleura adherent on both sides, demonstrated by attempted bilateral intrapleural pneumothorax. B. Bilateral extrapleural pneumothorax.

5. Rupture of cavities near the periphery, due to necrosis caused by destruction of blood supply. This can be prevented only by the proper selection of cases.
6. Wound infection, which is disastrous when it occurs.
7. Contralateral spread. The same steps should be taken as in thoracoplasty to prevent this.
8. Loss of extrapleural space. Careful postoperative management will prevent this.
9. Atelectasis of the lower lobe. The same measures should be taken as in thoracoplasty.

TABLE I: EXTRAPLEURAL PNEUMOTHORAX

Davidson County Tuberculosis Hospital, December 1938-June 1941 (2½ Years)

Number of patients.....	48
Number of lungs collapsed.....	51
Number of operations.....	52
Bilateral extrapleural, pneumothorax.....	3 patients
With contralateral intrapleural, pneumothorax.....	13 patients
Combined intra- and extrapleural, with division of septum.....	2 patients
Basal extrapleural.....	1 patient
Successful operations (46 on 42 patients).....	88.4%
No complications (34 operations, 32 patients).....	64.4%
Conversion of sputum (in 35 patients).....	75.0%
Operative mortality.....	0.0%
Late mortality (4 patients).....	8.3%

TABLE II: COMPLICATIONS OF EXTRAPLEURAL PNEUMOTHORAX IN SERIES OF 48 PATIENTS

Immediate operative complications in 6 patients	
Inability to establish sufficient space.....	1
Pulmonary tissue known to be entered at operation.....	3
Breaking down of wound (pyogenic).....	2
Late complications in 11 patients	
Extrapleural bronchial fistula.....	4
Tuberculous empyema without fistula.....	7
Contralateral spread.....	1
Late deaths, 4 patients	
Cardiac.....	1
Progressive disease and bronchial fistula.....	1
Respiratory infection with low vital capacity.....	1
Wound infection and progressive disease.....	1

The late complications are: empyema (tuberculous and mixed), bronchial fistula, and loss of extrapleural space.

The accompanying figures and tables show the complications and results in a

TABLE III: RESULTS OF EXTRAPLEURAL PNEUMOTHORAX: THREE- TO FIVE-YEAR REVIEW OF 48 PATIENTS

Disease under control (sputum negative)	
27 patients.....	56.2%
Disease still active or complications in space	
10 patients.....	20.8%
Dead	
11 patients.....	22.9%
Expansion being tried in 9 patients; space not completely obliterated in any to date.	

series of cases at the Davidson County Tuberculosis Hospital from December 1938 to June 1941.

## CONCLUSIONS

1. The indications for extrapleural pneumothorax are not definitely established, and it should be reserved for those patients in whom proved procedures cannot be used.

2. It offers a selective and effective collapse of the diseased portion of the lung and can be maintained over a sufficient period of time to allow healing.

3. Technically, it is a difficult procedure, and when complications occur they are more serious than in other forms of collapse.

4. The success of extrapleural pneumothorax is determined by securing adequate extrapleural space at the time of operation and careful postoperative management to maintain this space and prevent complications.

5. Complete expansion of the lung with obliteration of the space is unlikely, and thoracoplasty is now indicated in most of these patients.

Oakville Memorial Sanatorium  
Oakville, Tenn.

## DISCUSSION

C. C. Birkelo, M.D. (Detroit, Mich.): I want to compliment Dr. Alley on the excellent results which he obtained by extrapleural pneumothorax. Just before coming here, I looked up our results from this method of treatment and found that they were very poor. I believe the reason for this is that we use this method only as a last resort. We prefer thoracoplasty when this is possible, or cavernostomy for basal cavities.

## The So-Called Retarded or Occult Fractures

### Significance of the Parallel Projection in the Roentgen Diagnosis of Fractures<sup>1</sup>

BENEDICT J. TOTH, M.D.

Olean, N. Y.

ON OCT. 14, 1941, a 27-year-old truck driver was referred for roentgenographic examination of his right hip and knee, with the following history. In the early afternoon of Oct. 14, as he was climbing on the tailgate of his truck, it slipped and he was thrown to the pavement, landing on his right hip and right shoulder. He did not become unconscious but experienced severe pain. He got up and drove his truck a short distance, but the pain soon became unbearable, and he was brought to the hospital.

nation in the oblique projection showed no evidence of a fracture." The patient continued, however, to complain of severe pain in the right hip region for about ten days following injury. Gradually the pain subsided, although it did not disappear completely. The patient was discharged from the hospital on Oct. 31, seventeen days after the accident.

Because of continued complaints of pain in the right hip region, especially on certain movements,

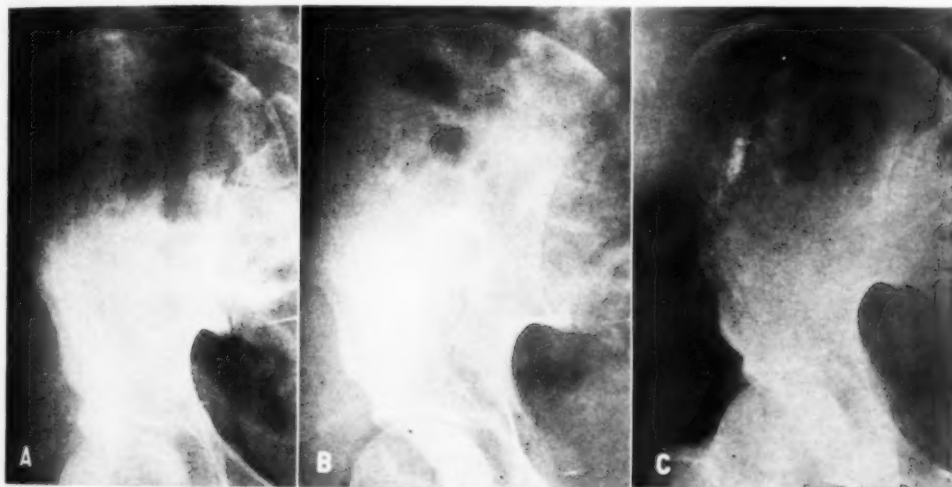


Fig. 1. A. Roentgenogram of pelvis, anteroposterior view, taken Oct. 14, 1941. B. Oblique view, taken Oct. 21, 1941. No definite fracture line is seen in either view. C. Anteroposterior roentgenogram of pelvis, Nov. 19, 1941. Note the large fracture gap with callus at the caudad end. There was no history of a second injury.

Physical examination revealed extreme tenderness on palpation and some excoriation just above the region of the greater femoral trochanter. The clinician's impression was that "most of the tenderness seemed to be in the muscle." The roentgen examination of the pelvis on the day of the injury was reported as follows: "There is no definite evidence of a fracture. To exclude, however, the possibility of some fissure fracture of the right innominate bone in its lateral portion, in view of the suggestive physical findings, an examination of the right hip in the oblique positions would be advisable."

On Oct. 21, a week later, a "radiographic exami-

the pelvis was radiographed again—in the anteroposterior position only—on Nov. 19, 1941, five weeks after the initial trauma. A huge fracture of the right innominate bone was discovered. There was no history of any injury in the period between the patient's fall on Oct. 14 and this last x-ray examination.

A careful restudy of the initial roentgenograms still failed to reveal any definite fracture line in the region of the large fissure fracture demonstrable five weeks later (Fig. 1).

After the experience of this unusual case, it became more or less our routine

<sup>1</sup> From the Departments of Radiology, St. Francis Hospital, Olean, N. Y., and City Hospital, Salamanca, N. Y. Read by title at the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America, Chicago, Ill., Sept. 24-29, 1944.

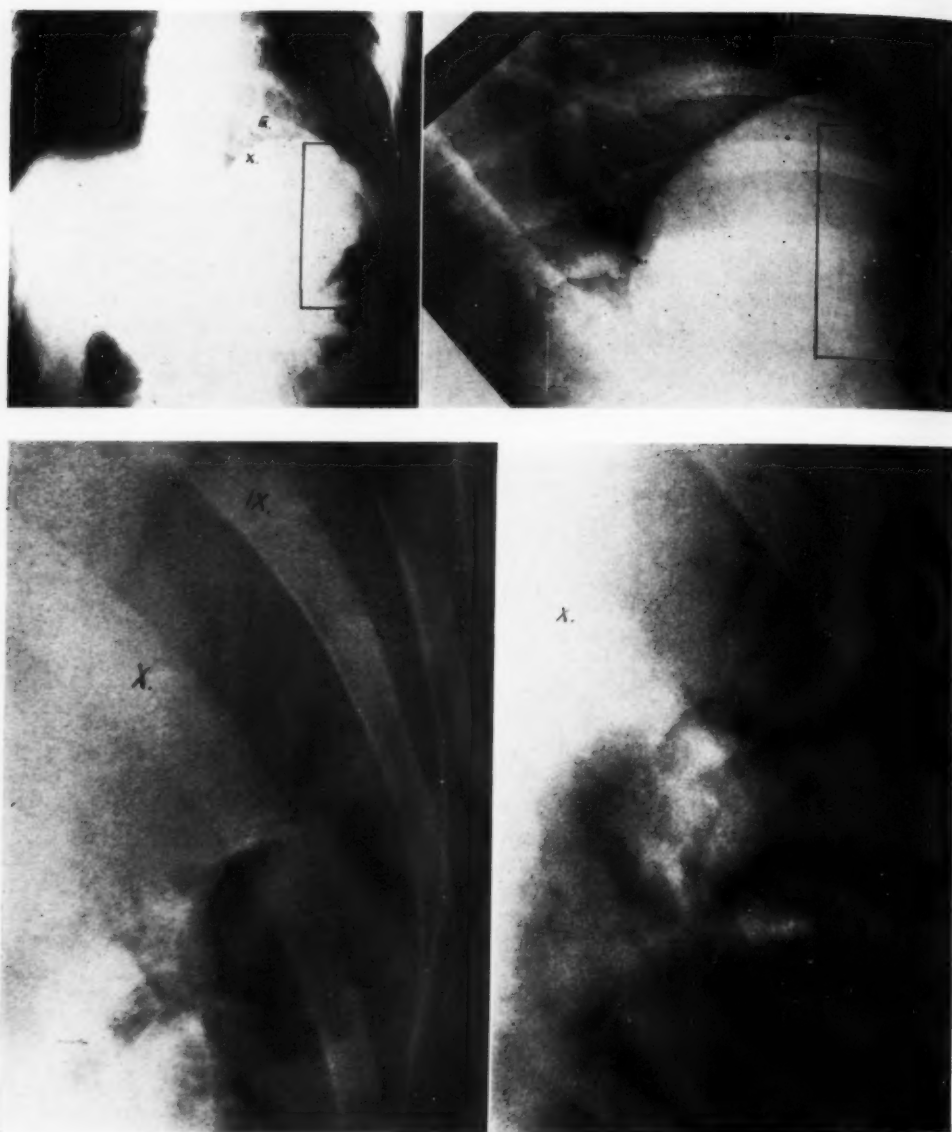


Fig. 2A. Anteroposterior and oblique roentgenograms (with magnifications below) made Feb. 20, 1943.  
No fracture is seen.

procedure to examine certain suspicious cases three or four weeks after injury. Since, as is well known, ribs are among the most difficult bones for fracture visualization, most of these repeated roentgenograms were requested in cases in which costal fractures were suspected. Displacement of fragments and a rather wide fracture gap

without noticeable displacement or callus were the positive radiographic signs of fracture in these late examinations. Routine anteroposterior or postero-anterior and lateral views (in rib cases anteroposterior or postero-anterior and one oblique exposure with the injured part close to the film) were usually employed (Figs. 2 and



3). Some cases came to our attention, however, where re-examination with the usual standard views failed to reveal the fracture and additional views were required (Figs. 4-6).

#### HISTORICAL

The literature of the last twenty years has been reviewed. That of the preceding years was not covered in view of the probably less adequate roentgen ray technic. Melnikowa, in 1929, discussed among other problems the question of invisible fractures, reporting 3 cases in which x-ray films taken immediately after injury failed to show any fracture. A few weeks later, however, fractures were clearly demonstrable in films taken "with the parts in the same position as before." The bones involved were the diaphysis of the ulna, shaft of a metacarpal, and shaft of a metatarsal. Melnikowa quotes Kimmerle, who in 1927 reported similar findings in the case of a fractured navicular and ribs. Lindeman, who had a similar experience with a fractured femoral neck, is also mentioned. Melnikowa, assuming that both exposures were technically without error, suggested two possible explanations for the difference between the two studies: (1) that the views were not exactly identical; (2) that lack of immobilization, resulting in frequent movements of the fragments, had probably caused pronounced hyperemia and absorption of the bony trabeculae at the fracture surfaces, thus resulting in a wider and sharper fracture line. Kimmerle held the second of these explanations as the more likely. The value of repeated roentgen examinations in suspected but "negative" cases was stressed by all these authors.

Jordan-Narath, in 1932, discussing fractures which are most frequently missed, mentioned *too early x-ray study* as one of the errors. According to him, infractions are frequently visualized for the first time only fourteen days after the injury.

Masmonteil, in 1935, in an article "*Fractures à retardement ou fractures avec déplacement en deux temps*," emphasized



Fig. 2B. Anteroposterior roentgenogram (same case as Fig. 2A) March 6, 1943. The displacement of the fragments of the left 9th rib is several millimeters. A fracture of the left 10th rib with slight displacement of the fragments is also noted.

the scientific as well as the medicolegal value of a second x-ray examination about two weeks following the initial study. In one of the two cases which he describes, the original roentgen examination of the right hip, in two projections, showed no evidence of a bone lesion. Thirteen days later, be-

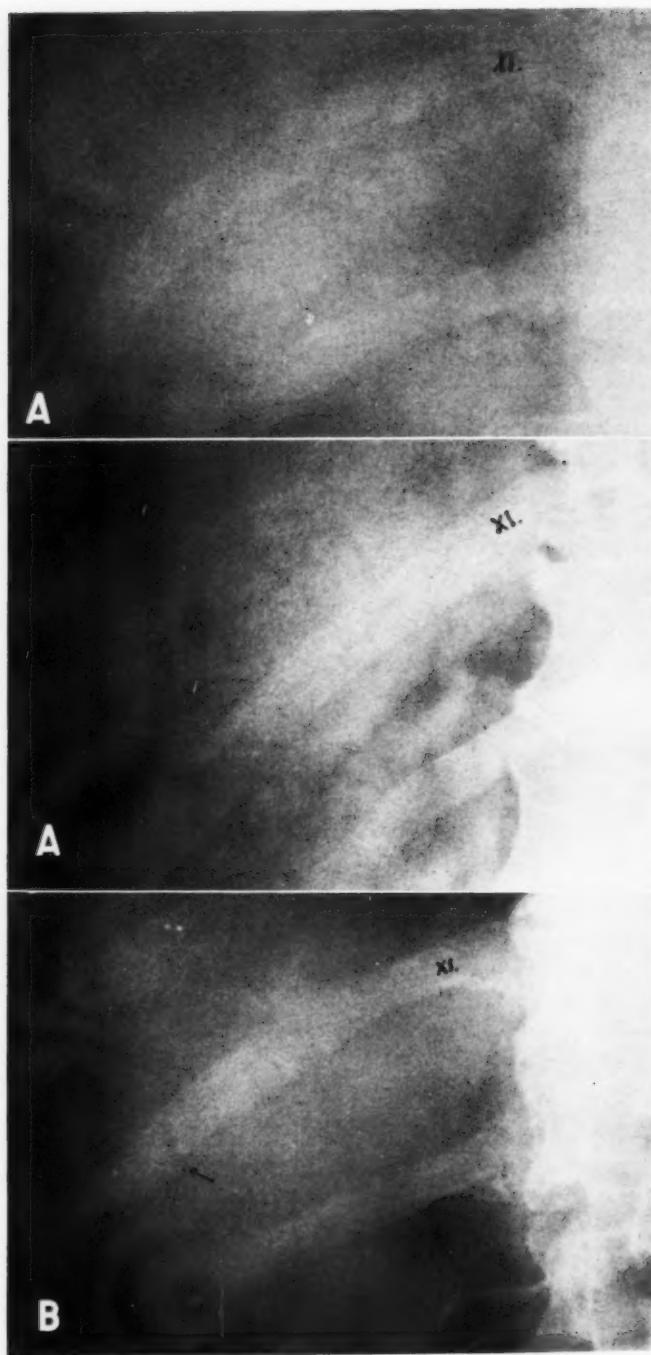


Fig. 3. A. Anteroposterior and oblique roentgenograms, May 8, 1943. No definite fracture is seen. B. Anteroposterior roentgenogram, May 28, 1943. The fracture gap of the right 11th rib is indicated by the arrow.



Fig. 4. A. Fracture of the left radial head, quite clearly visible in the anteroposterior ulnoradial oblique, fracture-parallel projection, although this view is technically poor, with a blurred image. B. The other three views (anteroposterior, lateral, and slightly oblique) fail to demonstrate the fracture. (For the anteroposterior view the patient was unable to extend the forearm.) C. Practically the same view as A, without motion, showing the fracture gap distinctly. D. Anteroposterior and lateral projections, taken four months after the initial study, revealing no definite evidence of fracture. E. Parallel view, taken on the same day as D, still shows the fracture with some displacement of the fragments.

cause of the spontaneous aggravation of pain, a second x-ray examination was done, which revealed a fracture of the femoral neck with displacement of the fragments. In the other case, a clavicular fracture was detected ten days following the initial radiographic examination. According to Masmonteil, these cases pass through two stages: (1) a *traumatic stage*, with rupture of the osseous trabeculae, followed by thrombosis of the haversian vessels and consequent aseptic necrosis of the osseous segments; (2) a *reactionary stage*, in which the polymorphonuclears and macrophages enter into action, resorbing the dead cells together with the altered red corpuscles,

while the osseous substance begins to absorb through diastasis. This entire process is directed through the influence of the sympathetic nervous system, which regulates the actions of the vasomotors. The result is a progressive weakening of the haversian framework, which now easily gives in to the influence of muscular contractions. Thus on the tenth to the twentieth day the fracture will be revealed, with displacement.

Nau dealt with this subject in 1935 and 1936. He described three different signs of fracture demonstrable in the late roentgenograms: (1) formation of callus, (2) sudden or progressive displacement of

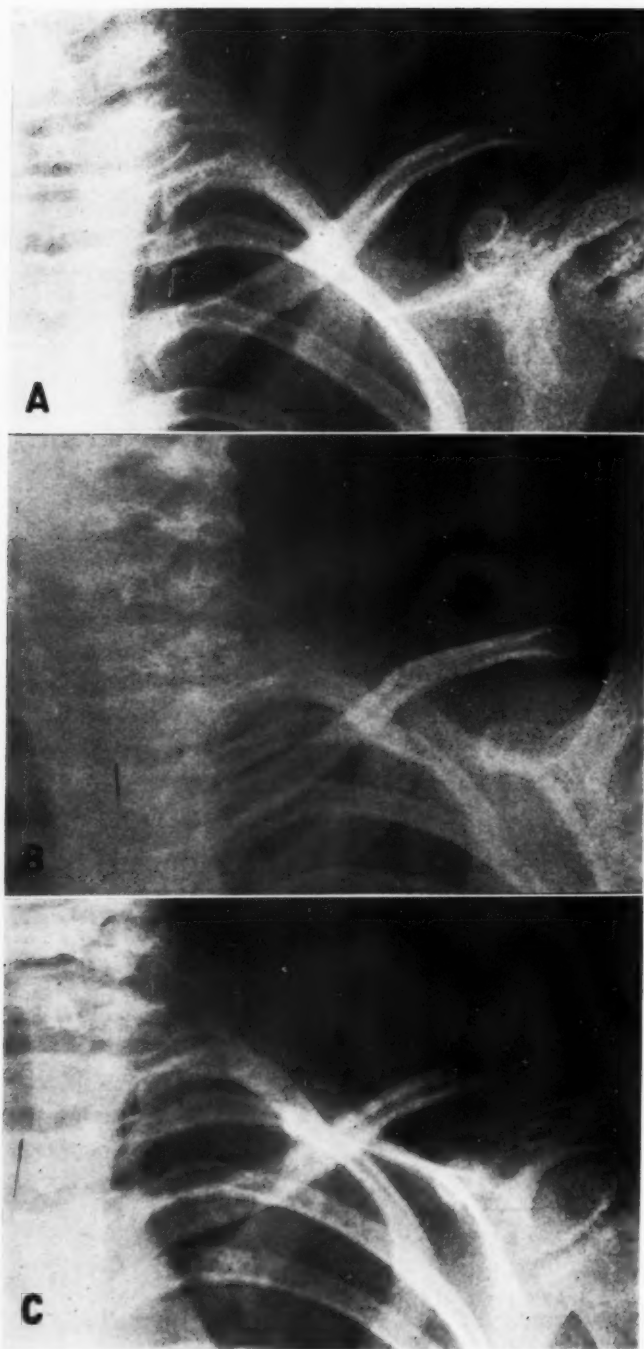


Fig. 5 A. Anteroposterior view of left clavicle. No fracture is seen. B. Postero-anterior view, taken at the same time, revealing a definite fracture. Note the difference in the two projections. C. Anteroposterior view two weeks later. The only evidence of fracture is some callus.



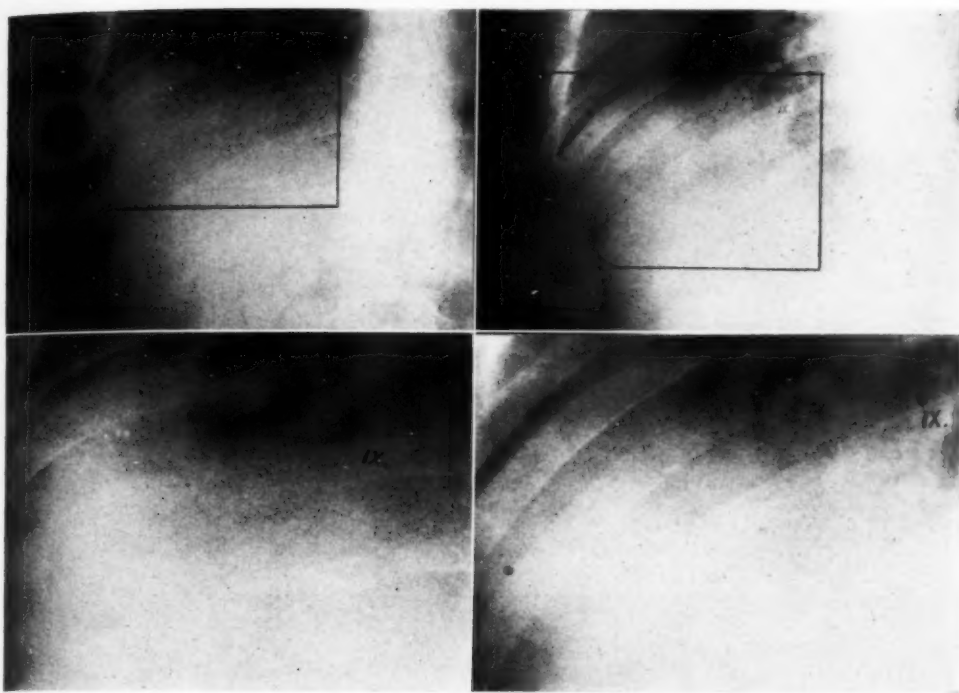


Fig. 6A. Anteroposterior and oblique views (with magnifications below) of ribs fifteen days after injury and two weeks after initial roentgenograms, showing a fracture of the right 8th rib with fairly wide gap. No fracture of the 9th rib is seen.



Fig. 6B. Opposite oblique exposure in case shown in Fig. 6A, taken on the day of the first x-ray examination, reveals a fracture of the right 8th and 9th rib, demonstrating the occasional superiority of individual initial study over "routine" re-examination.

the fragments, (3) appearance of a fracture gap through the calcareous resorption at the surfaces of the fragments. He considered six to eight weeks the optimum

time for re-examination. His studies included fractures of the ribs, toe, fibula, and scapula.

In 1941, Hammond and O'Connor presented their paper on "occult fractures" at the annual meeting of the American Medical Association. These authors believed that such fractures are not rare and that they are evidently missed in large numbers. They stressed the importance of the clinical examination in suspected fracture cases and concluded that in cases of doubt the physical examination should prevail. Other authors of recent years (Lachmann, Cohn) have also emphasized the great importance of the physical examination, apparently after repeated disappointments in the "verdicts" of the x-ray examinations.

#### PARALLELISM OF THE X-RAY BEAM AND THE FRACTURE

For the roentgen diagnosis of fractures the following signs are usually necessary:



Fig. 7. A. Anteroposterior and lateral views of right ankle, taken June 17, 1944, revealing a fairly definite fracture of the tibial end on the posteromedial aspect. B. Anteroposterior and lateral views, taken Aug. 8, 1944. These would easily be diagnosed as negative. C. Anteroposterior fibulotibial oblique projection (practically parallel with fracture gap) taken Aug. 8, 1944, showing distinctly a large fissure. Similar views on the first examination also revealed the fracture.

(1) fracture gap, (2) displacement, (3) change in the cancellous structure, such as the "folding" of torus fractures, the dense line of impacted fractures, etc., (4) signs of healing, (5) indirect signs, such as veiling of accessory nasal sinuses, etc., which, however, are not specific.

Our discussion is concerned chiefly with the *fracture gap*, and to some extent with *slight displacements*. According to Lachmann, apart from technical factors, such as poor equipment, motion, etc., the roentgen invisibility of fractures is due to the minute size of the fracture gap or to an

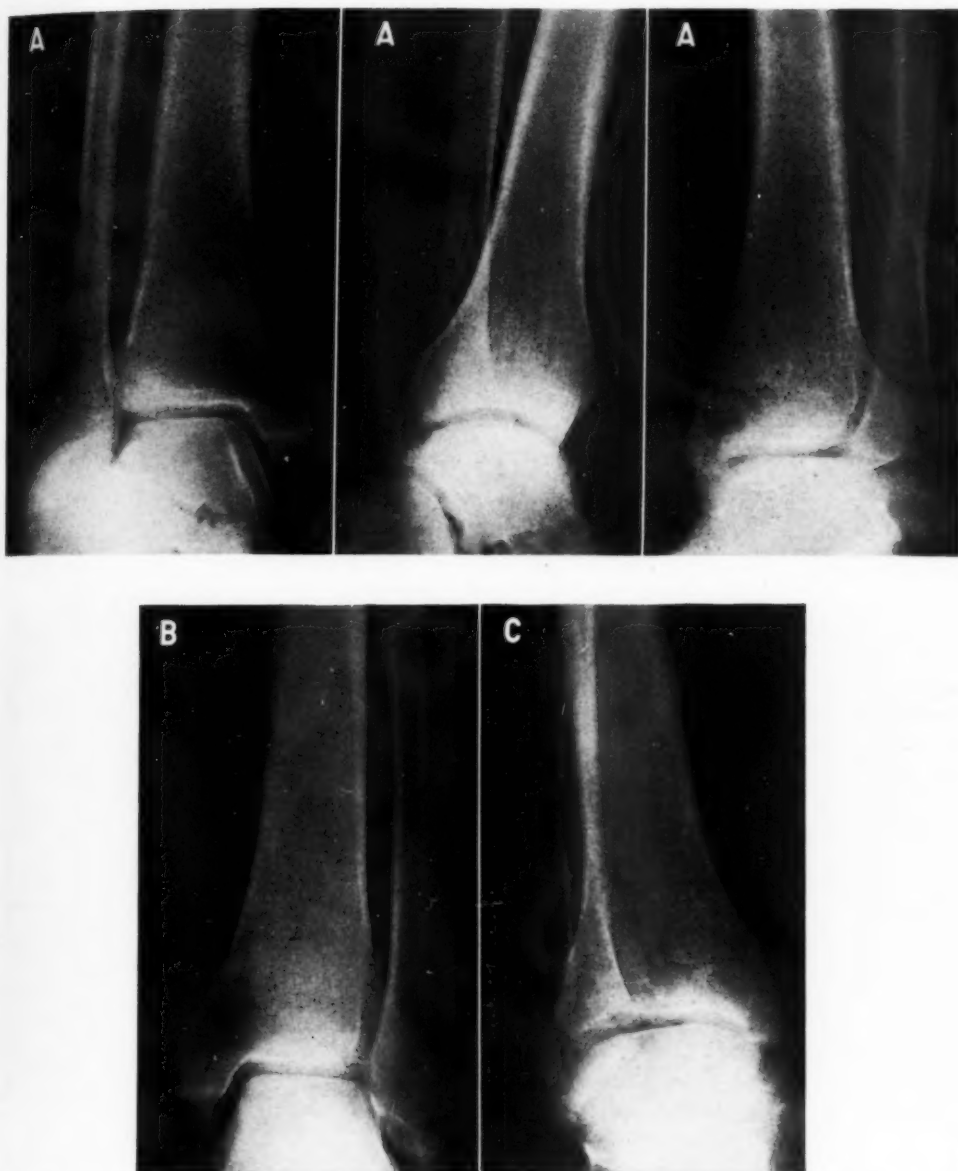


Fig. 8. A. Anteroposterior fibulotibial, lateral, and postero-anterior tibiofibular oblique views of the left ankle fail to reveal any evidence of a fracture. B. Anteroposterior view showing a short, faintly visualized fissure; the x-ray beam here approached parallelism with part of the gap. C. Anteroposterior tibiofibular oblique projection. This is practically parallel with the long fissure fracture, which is properly visualized.

insufficient number or wrong choice of projections. He agrees with Hunsberger that linear fractures can usually be demonstrated only if the x-rays traverse the bone

in the direction of the fracture line. Hill, discussing Hammond and O'Connor's paper, mentions the following principles for fracture visualization: (1) a roentgen-ray



Fig. 9A. Only the anteroposterior tibiofibular oblique, fracture-parallel view (third from left) of the four exposures of the right knee reveals definitely the fracture gap in the patella. Note the small scale-like chip fragment at the posterior aspect of the knee joint in the lateral view (arrow). Sometimes this alone is suggestive of occasionally extensive osteochondral fracture of the patella (Milgram).

tube of the finest focal spot obtainable, (2) non-screen film technic whenever possible, or fine detail intensifying screens where screens are required, (3) proper density of roentgenograms, (4) immobilization of the patient, (5) extra views in cases in which experience has indicated that fractures are commonly overlooked, (6) careful clinical examination by the radiologist before the patient is dismissed as negative, to make sure that all possible variations in positioning and technic have been employed for the case being examined. Pease suggests at least six different views of the wrist for a proper study of a questionable scaphoid fracture.

Of all these technical factors, we wish to emphasize the great importance of an exposure with the x-ray beam parallel or nearly parallel with the fracture line (Figs. 4, 7, 8, 9, 10). In the presence of all the important technical factors mentioned above, the fracture may still be invisible if the x-rays do not traverse the bone in the direction of the gap. On the other hand, if a parallel projection is obtained, films of comparatively poor quality will frequently reveal the fracture (Fig. 4, A). We have found, in accordance with Lachmann, Lewis, Garland, and others, that stereoscopic views in one projection are usually

not satisfactory substitutes for projections from different angles.

The importance of the parallel projection is also evident in cases of slight displacement, where the tangential view, in which the x-ray beam is actually parallel with the protruding fragment, is necessary for the proper demonstration of the fracture (Figs. 5 and 7). It is questionable whether the fracture visualization in certain cases reported by Nau was entirely due to a "sudden displacement" of the fragments. The different angle of the incident x-rays, resulting in a parallel or tangential projection, is probably more often responsible for the appearance of the fracture than an actual "sudden displacement" (Fig. 5).

#### COMPARATIVE VALUE OF THE INITIAL ROENTGEN STUDY AND THE ROUTINE RE-EXAMINATION

It is well known to all radiologists that there are certain bones which, either because of their position or because of their anatomical configuration, usually present difficulties in the diagnosis of fractures. Such bones include, among others, the clavicle, ribs, scapula, humeral head, head of the radius, carpal scaphoid, metacarpals, innominate, femoral neck, ends of the tibia, and metatarsals. It is these structures es-



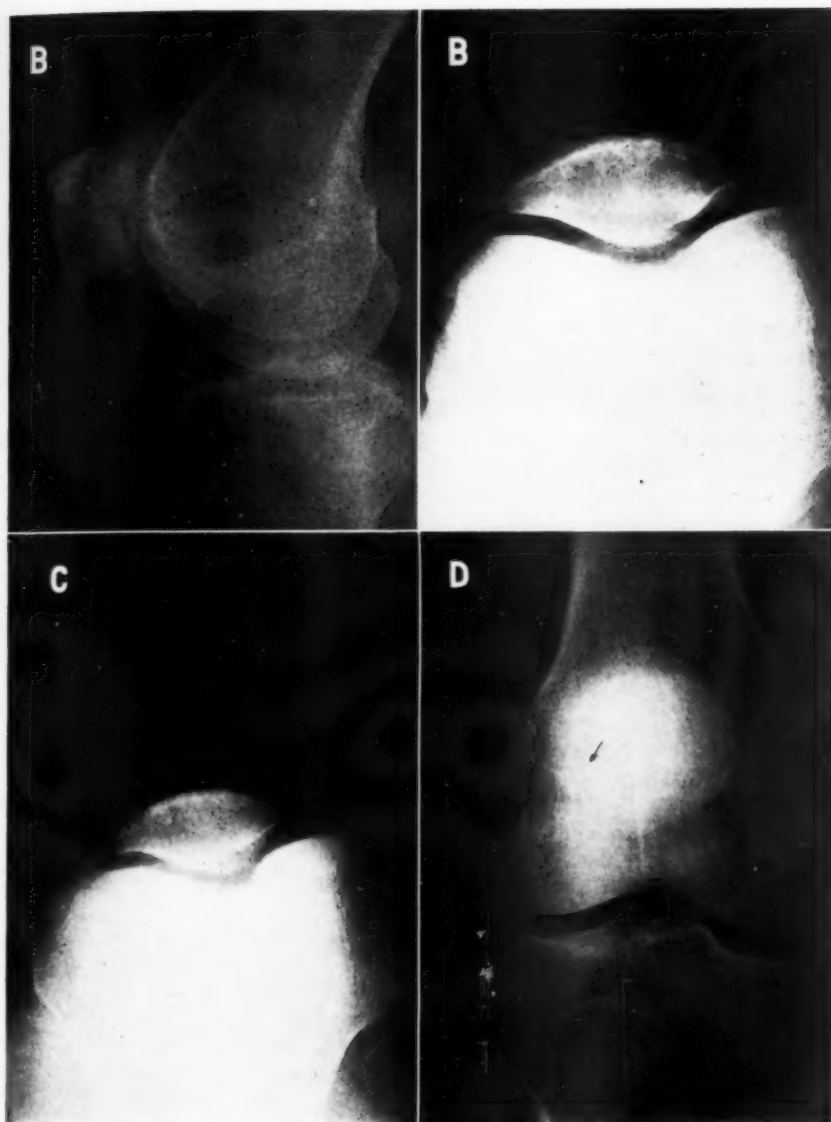


Fig. 9 B-D. B. Lateral and tangential views of case shown in Fig. 9A, taken about five weeks later, still revealing no evidence of a fracture. C. One of the tangential views on this re-examination shows the fracture, apparently due rather to an incidental change in position, giving a more nearly parallel projection, than to reparative changes of a true retarded fracture, since other tangential views failed to demonstrate the gap. Note the positional difference between the tangential views. D. An overexposure in the re-examination also shows the fracture line, which is evidently closely parallel with the incident x-ray beam. C and D would have been easily classified as "occult fractures."

pecially which need careful individual consideration. (The skull and spine are not included in our present study.)

In view of the prerequisite of a parallel

projection for proper x-ray visualization in "negative" fracture cases, two exposures, preferably opposite oblique, should be added to the ordinary anteroposterior or



Fig. 10. A. Anteroposterior and lateral views of left ankle, taken July 16, 1944. There are suspicious but not definite signs of a fracture of the fibula. B. Anteroposterior view, taken Aug. 16, 1944, showing a fairly typical "retarded" fracture of the fibula. C. Postero-anterior tibiofibular oblique view, July 16, 1944, showing the fracture line distinctly.

postero-anterior and lateral views. With these, the rays usually approximate the direction of the fracture sufficiently to achieve roentgen visualization. In case of an especially fine and short fissure, the range of the  $45^\circ$  angle of the four views may still have to be decreased, perhaps to  $30^\circ$ , with the aid of two additional projections, *i.e.*, six views altogether. If the six views fail to reveal a fracture and the case clinically is still suspicious, a restudy in three to five weeks should be suggested, at which time the reparative processes and/or displacement will aid in the diagnosis. Retarded fractures after such individual study, however, are rare, usually being small and consequently of less clinical significance.

Where no proper lateral view can be taken, as in the case of the ribs, clavicle, innominate, metacarpals, and metatarsals, at least two or more oblique views, closely correlated with the physical findings (especially the most tender spot), are necessary for the diagnosis. After such an examination many "minute" but important fissures will be diagnosed which otherwise might have been classified as retarded or occult fractures (Figs. 9 and 10). The fractures of the innominate bone reported in the first part of this paper, we believe, do not belong definitely in the group of "in-

visible fractures," since only two exposures of a bone with a curved anatomical configuration in a complicated position had been taken. It is possible that one or two additional views might have "caught" the fracture line.

The individual study of our series of fractures in comparison with re-examination of routine views, revealed three different types of cases:

- (a) Cases where neither the initial nor the follow-up standard views showed evidence of fracture. Some of the initial additional views clearly presented the fracture line (Figs. 4, 5, 6, 9).
- (b) Cases where the initial standard views showed no evidence of fracture but routine follow-up views revealed it. Some initial special views, however, also showed the gap distinctly (Figs. 9, 10).
- (c) Cases where the initial routine views revealed slight but definite evidence of fracture, while the additional parallel view presented a large fissure. Standard follow-up views (not exactly duplicating the first positions) revealed no evidence of a fracture (Fig. 7).

In all these cases the part was properly

immobilized, usually by cast, after the initial roentgen examination.

#### COMMENT

After a careful analysis of our cases, as well as those reported in the literature, it is felt there are certain points which deserve special emphasis.

(1) Practically none of our cases which, after negative initial roentgenograms, showed fractures on a second examination, had had a proper individual study. There were two rib cases, however—one with three and another with four views—which showed no evidence of fracture on the first examination.

(2) In the great majority of reported cases of "invisible fractures" only a routine roentgen examination was made, with the standard anteroposterior and lateral exposures; many times with only one view, as in fractures of the clavicle, scapula, ribs, etc.

(3) Several of the authors were not radiologists, and possibly were not as familiar with x-ray technic as those properly trained in the specialty.

(4) Many of the bones reported as showing retarded fractures were hard to visualize properly in routine roentgen studies because of their location, and many times only one view was sufficiently satisfactory for interpretation. In the case of the *pate*lla, for example, the lateral exposure is many times the only routine view giving satisfactory visualization. Often, in the case of the *clavicle*, *femoral neck*, and *scapula*, only one view was taken.

(5) In almost none of the rechecked cases was the position for the initial films exactly duplicated. Consequently the latter projections increased the possibility of an exposure nearly parallel with the fracture line. Occasionally only a slight difference in the angulation is sufficient to "catch" the fracture line. The positions in the second examinations in the various recorded cases often revealed considerable difference from those for the first study, apart from the different angle of the incident x-rays.

(6) There are just as great difficulties in fracture diagnosis as in any other field of radiology. Hunsberger stated, many years ago: "The diagnosis of fractures is far from being a simple matter"; yet there is still a general belief among many practitioners that anyone can read "a crack in the bone." Garland's suggestion that the x-ray interpretation instead of the films should be submitted in medicolegal cases should include even such "simple problems" as fractures. Regarding the "insignificance" of fracture diagnosis, Garland aptly states: "The specialist may be forgiven for overlooking a small carcinoma, he is *never* excused for missing a fracture." We agree with Hill when he states that a careful clinical examination should be done by the roentgenologist before the patient is dismissed as negative to make sure that the proper individual roentgen study has been made. In a better co-operation with the clinician, the attending physician should preferably designate the involved bone, instead of the region, for roentgenological study.

#### CONCLUSIONS

1. In the great majority of reported retarded or occult fractures, the original roentgen study was incomplete.

2. True invisible fractures are rare.

3. Individual initial roentgen studies, in correlation with the physical findings, are frequently superior to routine re-examinations.

4. The usual standard anteroposterior and lateral views are insufficient for fracture visualization in a large number of cases.

5. Special attention should be paid to the importance of exposures parallel with the fracture line.

6. The roentgenologist should be aware of the possibility of true retarded fractures and suggest re-examination in some questionable cases.

NOTE: The writer wishes to express his thanks to Miss G. E. Dry and Mrs. R. Matker for their technical assistance.

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## A Comparative Clinical Investigation of Cholecystographic Preparations<sup>1</sup>

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THE SUBJECT of cholecystography occupies a prominent place in medical literature. The numerous articles on the subject since the original paper by Graham and Cole (1) appearing only twenty years ago attest the fact that improvement was desired and was being sought. In spite of this apparent, almost continuous effort, very little improvement in the examination has been made. Improvement in radiographic equipment and films has resulted in much better radiographic detail, but this advance was not the direct result of attempts to improve the method of gallbladder examination.

Simplification and greater accuracy should be the aim in any modification of an established technic. Most of the changes in cholecystographic examinations, however, during the past twenty years, have made the procedure more complicated, with a questionable increase in accuracy. The major exception was the change from intravenous to oral administration of the medium. Elimination of undesirable side effects and an accompanying increase in patient co-operation are considered aids in simplification of existing technics.

Recently a new contrast substance for gallbladder visualization has been introduced. A review of the limited literature on the new preparation led to the belief that a revolutionary step had been taken. A critical analysis, however, revealed a wide variation in percentage of side reactions and shadow densities, and only one report of a direct comparison between the new drug and the sodium salt of tetraiodophenolphthalein.

In view of the favorable reports, and the

discrepancies among published accounts, we decided to make a comparison between the two preparations. This has been accomplished by alternating the two drugs through a series of 100 consecutive, unselected cases referred to the x-ray department for radiographic examination of the gallbladder. In addition, 10 healthy persons, without clinical evidence of gallbladder disease, were given both preparations. Although our series is small, we believe the results warrant their addition to the literature. In this way, sufficient data may accumulate within a short time to permit accurate evaluation of the advantages and disadvantages of the new preparation, beta-(4-hydroxy-3,5-diiodophenyl)-alpha-phenyl-propionic acid.

In Germany this new medium is known as Biliselectan. In the United States, the first commercial preparation was marketed under the trade name of Priodax.<sup>2</sup> Another has recently appeared on the market. For the sake of simplicity the name Priodax will be used in this report instead of the chemical name.

We have not attempted to review the extensive literature on the subject of cholecystography. The first reports on the new preparation came from Germany in 1940, where Dohrn and Diedrich (2) produced a series of iodine-containing substances which were tested by Junkmann (3) for suitability as cholecystographic media. This latter work was restricted to tests of general tolerance and biliary function in rats and rabbits. In these tests Biliselectan (Priodax) was outstanding by virtue of its good tolerance and was thoroughly investigated. Modell (4), in America, studied the pharmacology of

<sup>1</sup> Read by title at the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America, Chicago, Ill., Sept. 24-29, 1944.

<sup>2</sup> Schering Corporation.

TABLE I: REACTIONS TO CHOLECYSTOGRAPHIC MEDIA: PRESENT SERIES COMPARED WITH OTHERS IN THE LITERATURE

Author, Dye, and Number of Cases	None	Nausea		Vomiting	Diarrhea			Burning Urination	Miscellaneous
		Mild	Severe		Mild	Moderate	Severe		
Wasch (10) Priodax: 134 cases	43 (32%)	23 (17.6%)	2 (0.8%)	0	17 (12.6%)	..	1 (0.7%)	27 (20%)	Epigastric pain, 9 Headaches and dizziness, 5 ....
Dannenbergl (8) Priodax: 143 cases	9 (6.3%)	7 (4.9%)	17 (12%)	3 (2.1%)	3 (2.1%)	30 (20.9%)		24 (16.8%)	
Ochsner (12) Priodax: 300 cases	169 (56%)	52 (17.3%)	18 (6%)	8 (2.7%)	..	..		16 (5%)	Abdominal pain, 28 (9%)
Hefke (13) Priodax: 600 cases	...	48 (8%)		5 (0.08%)	48 (8%)	18 (3%)	..	3 (3% of 100 males)	....
Paul, Pohle, and Benson (5) Priodax: 114 cases	...	32 (28.1%)		2 (1.7%)	13 (11.4%)	6 (5.3%)	7 (6.1%)	17 (15%)	....
Tetraiodophenolphthalein: 80 cases	...	36 (45%)		4 (5%)	11 (13.7%)	4 (5%)	8 (10%)	..	....
Present series Priodax: 50 cases	19 (38%)	15 (30%)	1 (2%)	1 (2%)	8 (16%)	6 (12%)	4 (8%)	24 (48%)	Epigastric pain, 2 Slight headache, 2 Slight dizziness, 1 Severe headache, 2 Severe sneezing, 1
Tetraiodophenolphthalein: 50 cases	12 (24%)	12 (24%)	22 (44%)	4 (8%)	11 (22%)	7 (14%)	7 (14%)	2 (4%)	

Priodax, using cats as the experimental animal. The work of these investigators has been reported, and their results quoted, by several authors, and need not be considered at length here. Their conclusions warrant the assumption that Priodax is sufficiently non-toxic in the dosages used for cholecystography that it may be considered a safe drug.

Junkmann's (3) work suggests that the main advantages of the new preparation rest on the fact that most of it is eliminated in the urine (more than 50 per cent in the first twenty-four hours), while very little tetraiodophenolphthalein is thus excreted; most of the latter is eliminated by way of the intestinal tract, thus causing more gastro-intestinal symptoms. In addition, Junkmann (3) found the iodine content of the bile to be much greater after administration of Biliselectan (Priodax) than after the administration of tetraiodophenolphthalein.

In the present series of cases, the two drugs were alternated between patients because we believed a more direct comparison of the side effects could be made in this way. One's ideas of degree in evaluating severity of symptoms is prone to change or be influenced by anticipated results unless kept in balance by a continuous control. By constantly checking one drug against the other, such a balance, in my opinion, is best obtained.

Of the 100 patients, 53 were referred from the Outpatient Clinic and 47 were hospital cases. All had symptoms sufficient to warrant a request for cholecystographic examination.

The same routine was followed in all cases. A lunch of moderately high fat content was given at noon. A fat-free evening meal was given, followed in one hour by administration of the contrast substance to be used, either 3.5 gm. of tetraiodophenolphthalein or 3.0 gm. of Priodax. The tetraiodophenolphthalein was given dissolved in water. Priodax was given in six 0.5 gm. tablets to be swallowed with water at five-minute intervals. After this, nothing was permitted by mouth except

water until the roentgen examination the next morning. Films were made at fourteen and sixteen hours. The single-dose method was used throughout.

The side reactions in this series of patients are listed in Table I. In addition, all investigations reported in the literature and considered of any value for comparison with the present series are listed. Some minor variations occur in the classification of the side reactions, but most reports coincide roughly with the classification used by Paul, Pohle, and Benson (5). We have followed this latter classification for the sake of uniformity, simplicity, and clarity, adding a column for those cases without side reactions and omitting "burning throat," which proved to be an insignificant occurrence in our series. Because of the reactions in our normal group, referred to later, the degree of nausea was considered of significance; hence this symptom has been classified as mild and severe. Except for these changes, a direct comparison can be made with the series reported by Paul, Pohle, and Benson (5).

After taking Priodax, 19 patients (38 per cent) reported no side reactions, while 12 patients (24 per cent) had no side reactions with tetraiodophenolphthalein. Nausea occurred in 16 (32 per cent) of the Priodax cases and in 34 (68 per cent) of those receiving tetraiodophenolphthalein. In addition, only one patient (2 per cent) reported severe nausea with Priodax, but 22 (44 per cent) had severe nausea with tetraiodophenolphthalein. Vomiting occurred rarely with either drug: once (2 per cent) with Priodax and 4 times (8 per cent) with tetraiodophenolphthalein. Diarrhea was present in 18 (36 per cent) of the Priodax cases and in 25 (50 per cent) tetraiodophenolphthalein cases—possibly not a significant difference in such a small series—nor was there any striking difference in the various degrees of diarrhea.

Burning on urination with the first morning voiding was reported by 24 (48 per cent) of those receiving Priodax and, strangely, 2 (4 per cent) reported a similar symptom with tetraiodophenolphthalein.

TABLE II: REACTIONS IN 15 PATIENTS GIVEN BOTH PRIODAX AND TETRAIODOPHENOLPHTHALEIN

Dye	None	Nausea		Vomit- ing	Diarrhea				Burn- ing Uri- nation	Miscellaneous
		Mild	Severe		Mild	Moder- ate	Severe	Total		
Priodax	4	4	1	1	3	1	1	4	5	Headache, 1 Pain in epigas- trium, 2 Burning in epigas- trium, 1
Tetraiodophenol- phthalein	3	5	6	1	4	2	4	9	0	....

The former can be accounted for by the large amount of the drug excreted in the urine during the first twenty-four hours, but an insignificant quantity of tetraiodophenolphthalein is supposed to be thus eliminated. Miscellaneous symptoms were so mild and occurred so infrequently that they require only brief mention. With Priodax, 2 patients complained of mild epigastric distress, 2 had mild headaches, and 1 slight dizziness. With tetraiodophenolphthalein, 2 patients complained of severe headaches and 1 had a spell of violent sneezing.

In this series, several studies were repeated when no shadow or a poor shadow was obtained at the first examination. In almost all instances, Priodax was given at the second examination because, as our figures show, more failures occurred after tetraiodophenolphthalein and because it was difficult to get staff physicians to refer patients back for a second examination if tetraiodophenolphthalein was the dye to be used. The same difficulty was not encountered when the reverse was true. This fact in itself appears significant.

In fact, near the end of our series some difficulty was encountered because the staff physicians began to request that Priodax be given or that we arrange their patients in the series so that they would receive Priodax. These requests were ignored, with one or two exceptions. This observation has made a strong impression on me, for the radiologist, in spite of his desires to the contrary, does not have the close contact with, and continued observation of, his patients that is the privilege of the clinician.

Table II presents the side reactions in 15 patients who received both dyes. At least five days elapsed between examinations to preclude the possibility of a cumulative effect. As mentioned previously, Priodax was the second drug in almost all instances. A study of the table reveals that the chief differences were in the incidence of nausea and diarrhea and the severity of these symptoms. With Priodax, 5 patients complained of nausea, but in only one instance was it severe; but with tetraiodophenolphthalein, 11 patients had nausea and in 6 it was severe. The diarrhea was severe in only one of 4 patients complaining of this symptom after Priodax, while 4 of 9 patients had severe diarrhea after tetraiodophenolphthalein. In 3 cases there was moderate epigastric distress or burning and one patient had a mild headache after taking Priodax. There were no similar complaints with tetraiodophenolphthalein.

In addition to the series of 100 patients, 10 volunteers were given both preparations at least five days apart. In these cases, 5 were given tetraiodophenolphthalein first and 5 received Priodax first. These were so-called normals, or persons without clinical evidence of gallbladder disease. They were x-ray technicians, nurses, interns, and one stenographer. Seven were females and 3 were males.

The side reactions in these 10 persons are listed in Table III. It is significant that 6 of the 10 had no symptoms after taking Priodax, while only 2 were free from symptoms with tetraiodophenolphthalein. None complained of nausea with Priodax, but 8 had this symptom after tetraiodophenolphthalein and in 7 it was severe. For this



TABLE III: REACTIONS IN 10 NORMAL SUBJECTS RECEIVING BOTH PRIODAX AND TETRAIODOPHENOLPHTHALEIN

Dye	None	Nausea		Vomit- ing	Diarrhea				Burn- ing Uri- nation	Miscellaneous
		Mild	Severe		Mild	Moder- ate	Severe	Total		
Priodax	6	0	0	0	1	0	2	3	1	None
Tetraiodophenol- phthalein	2	1	7	1	2	0	2	4	0	Pain in abdomen, 1

reason, nausea is considered of major importance and is subdivided into mild and severe, as mentioned previously. In respect to other symptoms there was no great variation between the two drugs. After completion of both examinations each subject was asked the question, "If you had to submit again to an x-ray examination of the gallbladder, which preparation would you prefer?" The reply of all was, "Priodax." The reason in most cases is obvious, but those with mild or no reactions preferred the Priodax because of the ease of taking it; all complained of the "sickening taste" of tetraiodophenolphthalein.

From Tables I, II, and III, the most significant observation is the fact that nausea of severe form occurred much more frequently with tetraiodophenolphthalein than with Priodax, in our investigation. Since severe nausea is a very distressing symptom, any procedure that will decrease its incidence is worth while. There is no great disparity between our figures and those of Paul, Pohle, and Benson (5), but they minimize the importance of nausea and fail to evaluate the degree. Vomiting occurred in an insignificant number of cases with either drug, and this is in agreement with reports of others. Diarrhea occurred more frequently in our series than in any others in the literature, and was so common with both drugs that neither can claim a great superiority. This is contrary to the conclusions reached by Junkmann (3) but was suggested by the work of Modell (4). We also observed a greater number of patients complaining of burning on urination, but none of the patients attached any importance to this symptom, and its presence had to be elicited by leading questions.

The density of the shadows in our series of 100 cases is shown in Table IV, and our

results are compared with those of others. The value of a comparison of this kind is dubious unless one knows the type of patients referred for examination. This is forcefully illustrated by the figures of Kleiber and Rating, as given in Table IV. Kleiber (6) reports 45.6 per cent of 55 patients showing no shadow, while Rating (7) reports 94.8 per cent of 96 cases showing good shadows after Biliselectan (Priodax). Yet both stress the advantages of this medium. It is obvious that the number of patients with disease of the biliary tract in any given series will materially affect the proportion of good shadows. However, a comparison of the shadow densities obtained from the two dyes in a series of patients referred by the same clinicians is of value. This is especially true when supported by evidence obtained from a series of 15 patients and 10 normal persons given both dyes.

In the present series of 100 patients, 8 (16 per cent) showed no shadow after Priodax, but in 19 (38 per cent) of the tetraiodophenolphthalein cases no shadow was obtained. Poor shadows were obtained in 8 (16 per cent) of the Priodax cases and in 11 (22 per cent) of the tetraiodophenolphthalein cases. Moderate and good shadows were obtained in 68 per cent of the Priodax studies and in only 40 per cent of those with tetraiodophenolphthalein. These latter figures agree with those of Paul, Pohle, and Benson (5) for Priodax, but there is marked disagreement between the 40 per cent of the present series and the 72.5 per cent of their tetraiodophenolphthalein cases. Since in our series the percentage of cases showing no shadows with tetraiodophenolphthalein is 18 per cent higher than in their series, and since our figures for Priodax agree with theirs,

TABLE IV: SHADOW DENSITY: PRESENT SERIES COMPARED WITH THOSE RECORDED IN THE LITERATURE

Author, Dye, and Number of Cases	No Shadow	Faint Shadow	Moderate Shadow	Good Shadow	Remarks
Lauer-Schmaltz (9)					
Biliselectan (Priodax): 45 cases	11 (24.4%)	1 (2.2%)	....	33 (73.3%)	.....
Kleiber (6)					
Biliselectan (Priodax): 55 cases	25 (45.6%)	...	....	...	Others not classified
Rating (7)					
Biliselectan (Priodax): 96 cases	....	...	....	91 (94.8%)	Remainder not classified
Marshall (11)					
Priodax: 50 cases	10 (20%)	1 (0.5%)	....	15 (30%)	Others classified on pathological basis
Wash (10)					
Priodax: 134 cases	28 (20.9%)	12 (8.9%)	19 (14.2%)	75 (56%)	.....
Dannenberg (8)					
Priodax: 143 cases	31 (21.7%)		11 (7.7%)	101 (70.6%)	.....
Ochsner (12)					
Priodax: 300 cases	93 (31%)		201 (67%)		Only figures given
Hefke (13)					
Priodax: 600 cases	60 (10%)	12 (2%)	48 (8%)	480 (80%)	.....
Paul, Pohle, and Benson (5)					
Priodax: 114 cases	29 (25.4%)	3 (2.6%)	10 (8.7%)	72 (63.3%)	.....
Tetraiodophenolphthalein: 80 cases	16 (20%)	6 (7.5%)	14 (17.5%)	44 (55%)	.....
Present series					
Priodax: 50 cases	8 (16%)	8 (16%)	11 (22%)	23 (46%)	.....
Tetraiodophenolphthalein: 50 cases	19 (38%)	11 (22%)	15 (30%)	5 (10%)	.....

the difference in the figures of the two series for moderate and good shadows with tetraiodophenolphthalein cannot be accounted for by the personal equation, which might enter into an evaluation of the density of the shadows.

TABLE V: SHADOW DENSITY IN 15 PATIENTS RECEIVING BOTH PRIODAX AND TETRAIODOPHENOLPHTHALEIN

Dye	No Shadow	Faint Shadow	Moderate Shadow	Good Shadow
Priodax	3	1	4	7
Tetraiodophenolphthalein	8	4	2	1

Tables V and VI show our observations relative to shadow density in 15 patients and the 10 normal persons receiving both dyes. On the basis of the examination with Priodax, 10 of the 15 patients would not be considered to have gallbladder disease, because of the moderate and good shadows obtained. However, of the same 15 patients, 9 would be considered definitely diseased, and 4 probably so, when tetraiodophenolphthalein was used. The

discrepancy between the figures in Table V and the ones listed here lies in the fact that in one case with opaque stones there was a moderate or good shadow with both preparations. It should also be noted here that one patient without x-ray evidence of gallbladder disease with either dye was later operated upon and found to have a cholecystitis with hemorrhages into the mucous membrane.

As was expected, in all of our 10 normal subjects a gallbladder shadow was demonstrable. Two, however, had a faint shadow with tetraiodophenolphthalein and would have required a second examination had they been patients.

One of the great advantages of Priodax is the fact that there is little or no residue of the drug in the colon. With tetraiodophenolphthalein, such a residue is an almost constant occurrence; it is frequently sufficient in the hepatic flexure to obscure a normal gallbladder shadow. In 5 of our cases, these confusing shadows were the major obstacle to an accurate interpretation. In all 5 cases, the difficulty was eliminated by resorting to the use of Priodax.

TABLE VI: SHADOW DENSITY IN 10 NORMAL SUBJECTS RECEIVING BOTH PRIODAX AND TETRAIODOPHENOLPHTHALEIN

Dye	No Shadow	Faint Shadow	Moderate Shadow	Good Shadow
Priodax	0	0	1	9
Tetraiodophenolphthalein	0	2	3	5

This advantage is mentioned in several reports in the literature but few stress its importance. Because of it, Priodax is not only more accurate, but it aids in the simplification of cholecystography, for as stated by Dannenberg (8), "No alkalies, drugs, pressor agents or paregoric are necessary," and to this we add the annoying enema or enemas.

#### SUMMARY

The results obtained in a series of 100 patients referred for x-ray examination of the gallbladder in which Priodax and sodium tetraiodophenolphthalein were alternated are reported. The results of the examination of 15 patients and 10 normal persons given both dyes are included. These results are tabulated on the basis of side reactions and shadow densities and are compared with the observations of others recorded in the literature.

#### CONCLUSIONS

Beta - (4 - hydroxy - 3,5 diiodophenyl) - alpha-phenyl-propionic acid—Priodax—is superior to sodium tetraiodophenolphthalein because it simplifies and at the same time increases the accuracy of cholecystography.

Priodax is more pleasant to take. Severe nausea occurs infrequently compared with its incidence following tetraiodophenolphthalein. Diarrhea is less severe. Gastro-intestinal symptoms occur more frequently, however, than is suggested by the first reports on the drug or the claims made for it.

The new drug has a great advantage over sodium tetraiodophenolphthalein in that it

produces shadows of the gallbladder more consistently, and usually of greater density. Gallbladder shadows are better visualized because of the absence of confusing opaque shadows in the hepatic flexure of the colon. From our experience this reliability appears of greater importance than the reduction in side reactions. This fact has not been stressed in previous reports.

Our findings vary from other published reports, but most of the latter present only the results obtained after the use of the new drug. Because the present series is small, it is hoped that other similar investigations, comparing the two drugs, will be made.

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## March Fracture<sup>1</sup>

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"MARCH FRACTURE" is a term applied to a fracture occurring typically in infantry recruits during training periods involving a great deal of marching. In contrast to the usual fracture, a march fracture does not result from a single definite traumatism. Formerly thought to be limited to the metatarsal bones, march fractures have now been reported by various authors in most of the weight-bearing bones of the lower extremity and pelvis (3). The terms "fatigue fracture," "stress fracture," "strain fracture," "insufficiency fracture," and "skaters' fracture" are synonymous with "march fracture." In civilians the condition is said to occur with some frequency in waitresses, shop attendants, and nurses as a result of the prolonged walking and standing in their respective occupations (4); a similar fracture has been reported in children (5).

### ETIOLOGICAL CONSIDERATIONS

The war program of infantry training was extremely strenuous, being planned to condition physically and train the recruit as a soldier within a period of a few months. The introduction of "speed marches" and prolonged hikes up to twenty-five miles placed a severe burden on the physique of the soldier in training. Practically every soldier was subject to much greater physical stress in the army than he had been as a civilian. As a result, march fractures were of common occurrence in the infantry troops undergoing training. In our experience these fractures are confined to no particular type of individual. We believe that they occur in a bone which is unused to strenuous activity and which has not accommodated itself quickly enough to accept the increased stress placed upon it. March fractures are at a minimum in well seasoned troops, in whom conditioning has apparently added

tensile strength to bone and related structures. The exact mechanism of the fracture has not been proved. Recently Breck and Higinbotham (2) have popularized the theory that the fracture occurs as a result of a molecular rearrangement of the bone, due to multiple small traumata; this rearrangement is thought to render the bone brittle and liable to fracture. Watson-Jones (6) describes the fracture as a simple crack fracture, which is so fine in character that it is frequently missed; it is not until new callus appears that the typical roentgen findings are present.

### SYMPTOMATOLOGY AND FINDINGS

The typical complaint is pain following a march, during which the soldier had been unable to keep up with his company. The pain is usually well localized to the affected area, which is tender on palpation. Gross swelling is evident on examination in case of the subcutaneous bones of the foot and leg. Motion of the adjacent joints in their extreme ranges may produce slight pain. In contrast to traumatic fractures, the ecchymosis due to soft-tissue injury is absent.

By far the most frequent site of march fracture is the shaft of a metatarsal, particularly the second or third (Fig. 1). The earliest roentgenographic sign is an incomplete subperiosteal fracture or a slight area of periosteal reaction (Fig. 1, A), from which usually develops a line of fracture extending completely across the bone. Displacement of the distal fragment (Fig. 1, B), as well as slight angulation, may occur at the fracture site. If the first evidence of fracture is recognized and strenuous activity is reduced, a complete fracture line may not occur. Healing usually ensues with abundant callus formation which is gradually absorbed in a period of months to form a dense, spindle-like thickening at the fracture site (Fig. 1, D).

<sup>1</sup> Accepted for publication in May 1945.



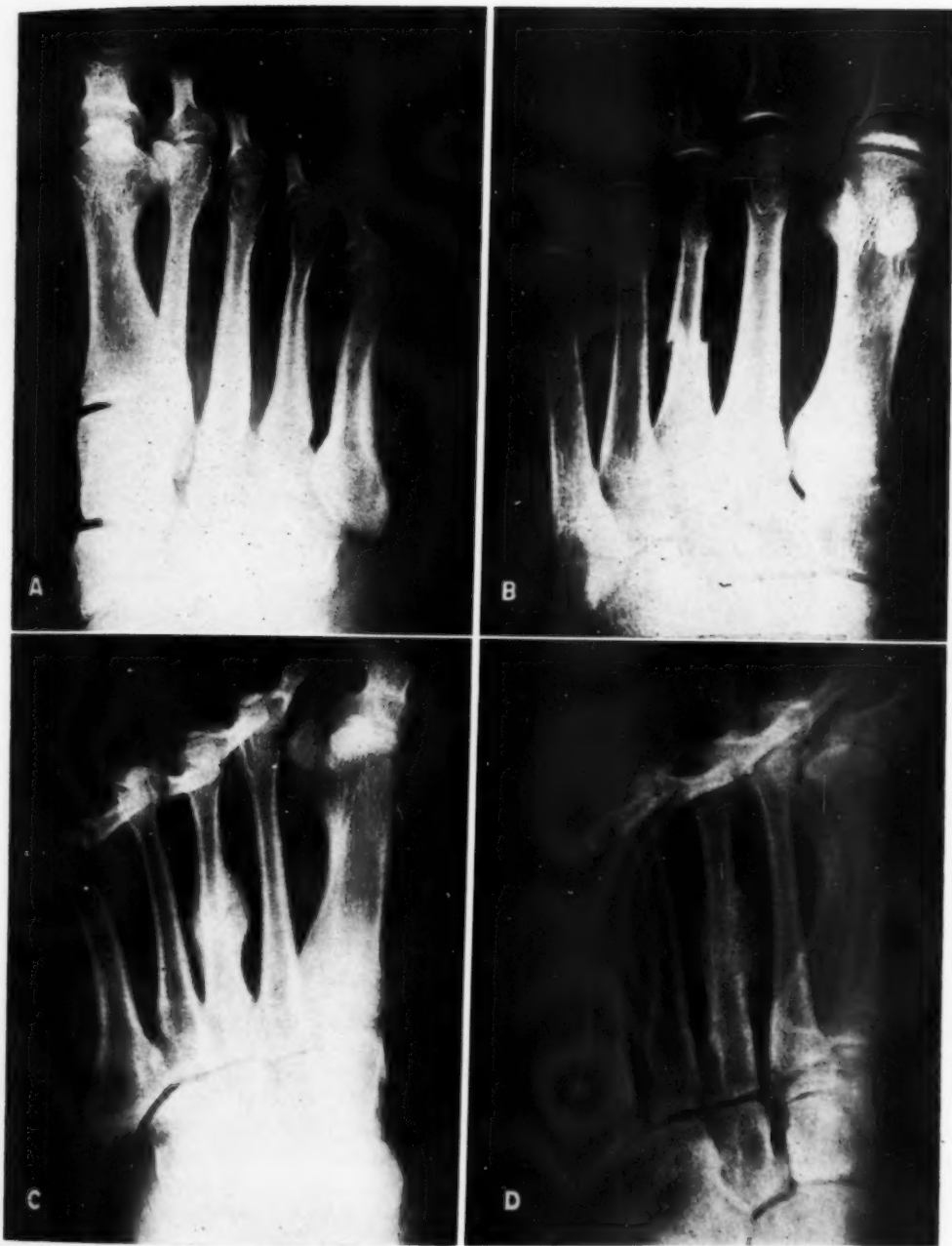


Fig. 1. Examples of various stages of march fractures of the metatarsals. A and B. Early. C. Intermediate. D. Late. In B the fracture line is complete, and there is displacement of the distal fragment. Frequently, the line of fracture is not quite so marked (B) and in instances may not go on to completion. It is indicated early by slight periosteal reaction, which increases as the process extends. C is a march fracture in intermediate stage, with ambulatory treatment, showing the large amount of callus, a complete fracture line, and slight displacement. The fracture shown in D, which also received ambulatory treatment, is firmly healed by a dense spindle-shaped callus.





Fig. 2. March fracture of the os calcis, evidenced by a band-like line of condensation extending about the waist of the bone. Examining the periphery, one will see a piling of periosteal bone-callus formation. We have never seen displacement in fractures in this region.

Fig. 3. March fracture of the distal shaft of the fibula, a fairly common site. In this fracture there is no displacement. Displacement occurs in march fracture when the line of fracture has been complete early and the fracture has not been immobilized.

A common cause of painful heels in infantry soldiers is march fracture of the os calcis (Fig. 2). It is evidenced roentgenographically some days after the onset of clinical symptoms by a line of bony

condensation extending across the waist of the bone. At the margin of the fracture line the cortical bone shows a periosteal reaction, best seen on the axial (plantar-dorsal) view (Fig. 2, B).



Fig. 4. March fracture of the upper shaft of the tibia. The upper shaft of the tibia is a frequent site of march fracture. In this example there is a complete fracture line, great callus formation, and no displacement.

Fig. 5. March fracture of the femur, a rather more infrequent site. Here again is a complete fracture line and considerable callus formation without displacement.

The long bones of the extremities are not infrequently the site of march fracture. In our experience the tibia is second in frequency only to the metatarsals. Too fre-

quently these fractures in the lower leg are overlooked as "shin splints." In the tibia the upper third of the shaft is more frequently affected (Fig. 4); in the lower por-



Fig. 6. March fracture of the base of the neck of the femur, an unusual site. There is no doubt as to correctness of diagnosis in this case. The patient was a husky young soldier of 22 who had worked as a farmer up to time of induction. Pain in hip was induced by walking, six weeks after entrance upon infantry training. Healing occurred without incident following restricted activity only.

tions of the shaft the subperiosteal reaction does not often develop into a complete transverse fracture line. In the fibula the distal portion of the shaft is most often involved (Fig. 3).

March fractures of the femur are seen less frequently; when present, they are likely to involve the lower third of the shaft (Fig. 5); more unusual is involvement of the femoral neck (Fig. 6).

The pelvis is a rare site of march fracture. Such fractures have received little general recognition as a cause of inguinal and hip pain in infantry soldiers. Usually the pubic rami are involved (Fig. 7).

#### DIAGNOSIS

The diagnosis is usually not difficult in the presence of a typical history, symptoms, and findings. The early periosteal reaction seen roentgenographically may be confused with a malignant growth (6). If the diagnosis is in doubt, a biopsy should be performed. In the opinion of the writers, this is seldom necessary.

#### PROGNOSIS

The prognosis in all march fractures is good as regards healing of the fracture. Certain patients continue to complain of mild pain after the lesion has healed. Any given march fracture may be followed by a similar fracture in another or the same weight-bearing bone; occasionally we have observed multiple successive march fractures in one individual.

#### TREATMENT

In treatment of these fractures we have recently come to place considerable em-



Fig. 7. March fracture of the pubis, in this instance bilateral. The patient, a 27-year-old soldier, complained of bilateral inguinal pain following a 3-mile "speed march." At the time he had been in infantry training only seven weeks. In our experience march fracture in this site is less frequent than in other bones.

phasis on ambulatory treatment at the suggestion of the orthopedic consultant of the Eighth Service Command. Such treatment prevents disuse atrophy of muscle and bone. Only in early cases with extremely acute symptoms is complete rest indicated. As soon as practical, the patient is allowed to be up and about with certain restrictions. In case of march fractures of the metatarsals without displacement, the patient's shoe is fitted with a longitudinal steel bar according to the plan of Bernstein and Stone (1). This permits completion of the greater part of his training program. March fractures of the metatarsals with displacement must be immobilized for a four-week period in a

walking cast if further displacement is to be avoided. With march fractures of the os calcis, restricted ambulatory activity is allowed, with no marching, drilling, prolonged walking or standing for a period of eight to ten weeks after the acute symptoms have subsided. Similarly, march fractures of the long bones and pelvis require a period of many weeks of restricted ambulatory activity before full functional activity may be resumed; the clinical and roentgenographic findings will determine when a return to full activity may be permitted in a given case.

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## Hiatus Hernia of the Stomach as a Source of Gastro-Intestinal Bleeding<sup>1</sup>

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**H**IATUS HERNIAS of the stomach and their complications, such as peptic ulcer and gastritis, are a grateful field for roentgen diagnosis. Clinical symptoms of great variety, often as alarming as sudden hematemesis, can be explained by roentgen demonstration of the displaced segment of the stomach. The importance of including hiatus hernia of the stomach in the differential diagnosis of bleeding lesions of the upper gastro-intestinal tract will justify the presentation of three additional cases of this kind recently observed on the medical service of Sparks Memorial Hospital.

The general classification of the diaphragmatic hernias and the mechanism leading to the displacement of portions of the stomach through the esophageal hiatus into the thorax, the so-called hiatus hernia, have been presented in excellent papers (4, 8). The hiatus hernia may or may not be combined with a congenitally short esophagus, the presence of which plays an important, but not an exclusive, part in the origin of this condition. Insufficiency of the muscular hiatus and of the surrounding connective tissue, acquired with advancing age, is considered the decisive etiologic factor. The positive pressure within the abdomen gradually forces segments of the stomach through the weakened hiatus into the thorax, where negative pressure exists.

Sixteen cases of hiatus hernia of the stomach have been observed in 1,000 consecutive gastro-intestinal examinations in the x-ray departments of Sparks Memorial Hospital and the Holt-Krock Clinic. This number includes only cases in which a sizable barium deposit outlining a gastric mucosal pattern was demonstrable above the diaphragm. A reflux of barium into



Fig. 1. Case 1. Large hiatus hernia of the stomach. The esophagus is rather short. The hernia is quite irregularly outlined, suggestive of swelling of the mucosal pattern.

the lower esophagus due to relaxation of the cardiac sphincter was more frequently found, but such cases are not included in this series.

The majority of the patients with true hiatus hernia were beyond fifty years of age. There were 8 females and 8 males. In a surprisingly large proportion of the cases, 5 out of 16, the diaphragmatic hernia was complicated by other lesions in the gastro-intestinal tract, an observation which has likewise been made by other authors (6). Duodenal ulcers were found in 2 cases, primary adenocarcinoma of the ileum with intestinal obstruction in another, while the 2 remaining patients showed multiple diverticula in the colon.

<sup>1</sup> Accepted for publication in May 1945.



The combination of diaphragmatic hernia with diverticulosis of the colon is well explained by the fact that both conditions are due to senile insufficiency of muscular and connective tissue.

In 3 of the 11 cases in which no other gastro-intestinal lesion was present, the hiatus hernia was practically asymptomatic. In 5, different degrees of epigastric pain and other digestive symptoms were

precordial pain, which could be relieved only by opiates. The patient was admitted Aug. 16, 1943, with a tentative diagnosis of coronary thrombosis.

During the first few days in the hospital, attacks of substernal pain continued, combined with shortness of breath and cyanosis. There was frequent vomiting of small amounts of dark blood. The patient was unable to retain food. The physical examination was not significant. The blood pressure was 155/80. An electrocardiogram (routine three leads) done immediately on admission revealed a normal rhythm. There was some evidence

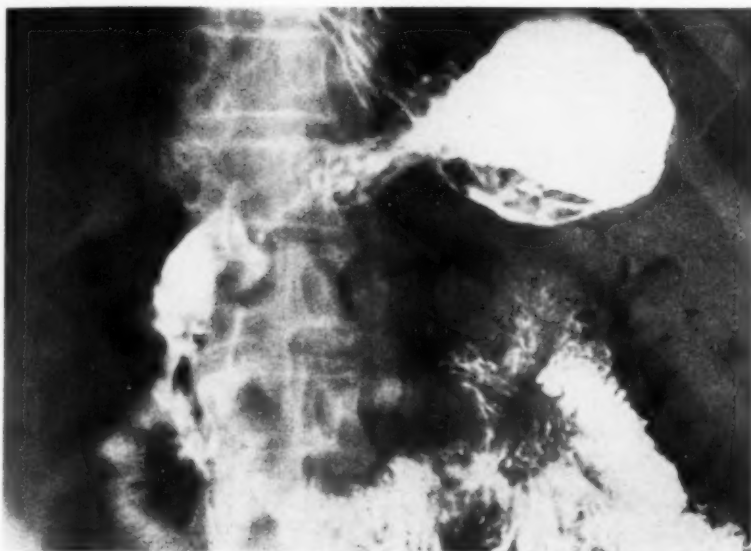


Fig. 2. Case 1. Note the gastric mucosal relief extending distinctly above the diaphragm.

recorded, and sufficiently well explained by the presence of the herniated stomach. A small peptic ulcer was found in only 1 of these patients. There was satisfactory response to medical management in all cases in this group.

Clinical symptoms of a bleeding lesion within the gastro-intestinal tract, manifesting itself in either hematemesis or microcytic anemia, brought the remaining 3 patients for x-ray examinations.

CASE 1: B. B., a white male, 65 years of age, gave a past history which was not contributory except for a syphilitic infection which had been treated adequately. For the past two weeks he had experienced occasional vomiting of small amounts of dark blood and dark brown liquid. There were no other digestive symptoms. The night before admission there occurred a sudden onset of severe

of myocardial damage, but no change suggesting a recent infarction (Dr. C. T. Chamberlain).

Treatment consisted of sedation with large doses of opiates, glucose parenterally, and oxygen. The condition of the patient gradually improved, and vomiting stopped after five days in the hospital.

Laboratory findings were as follows: red cell count 4,200,000, with hemoglobin 94 per cent; white cell count 6,150, with a normal differential; NPN 35.2 mg./per cent; urinalysis negative. Wassermann and Kahn reactions negative.

X-ray examination revealed a hiatus hernia of the stomach the size of an egg. The herniated portion of the stomach had an irregular outline and showed a coarse mucosal relief suggestive of a localized gastritis.

CASE 2: W. R. A., a white male, 45 years of age, gave a past history of no significance. He had been feeling perfectly well when, three hours before admission, he suddenly started to vomit large amounts of bright red blood. He was admitted as an emer-

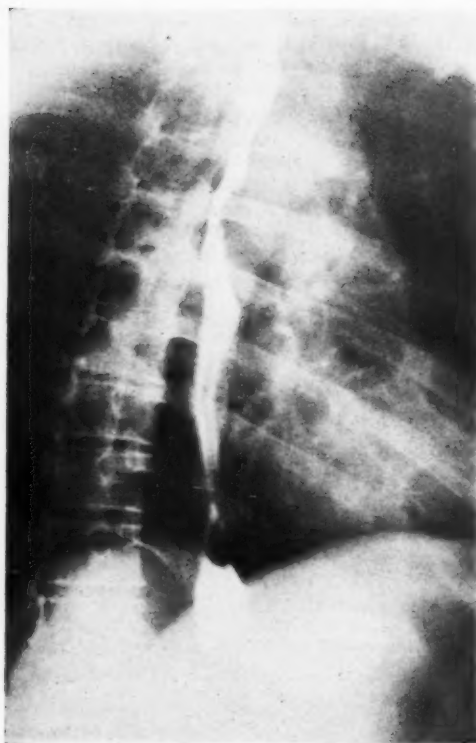


Fig. 3. Case 2. The elongated and tortuous esophagus enters the herniated portion of the stomach. Note constriction where the stomach passes through the muscular hiatus.

gency June 25, 1944, at 12:30 A.M., in a state of mild shock. Physical examination was not remarkable. No further bleeding occurred while the patient was in the hospital. He received several transfusions of plasma and whole blood and was discharged after a short observation period.

The red cell count was 3,480,000, with hemoglobin 70 per cent; white cell count 10,350 with neutrophils 80 per cent, lymphocytes 20 per cent. On the second day the hemoglobin dropped to 54 per cent and the red count to 2,610,000. Urinalysis revealed a trace of albumin and several hyaline casts.

X-ray examination showed the presence of a large hiatus hernia of the stomach which was irregularly outlined along its anterior wall. No ulcer was demonstrable. The upper gastro-intestinal tract was otherwise normal with the exception of a spastic duodenum.

The patient was again seen after six weeks of medical management. He felt perfectly well and had had no further episodes of hematemesis. His hemoglobin was up to 90 per cent, his red cell count to 4,830,000. A check-up study again revealed the hiatus hernia of the stomach. The duodenum was

now normally outlined, and any organic lesion in this area could safely be ruled out. Gastric analysis (fasting specimen): free HCl 12, combined acid 18. The highest values reached following a test meal were: free HCl 32, combined acid 46.

**CASE 3:** Mrs. J. H. H., white female, 60 years of age, had had pneumonia in 1926 and undergone a cholecystectomy in 1927. Her present complaints were weakness, some loss of weight, anorexia, and shortness of breath combined with pain in the lower chest. She was admitted on Dec. 21, 1943.

On physical examination the patient appeared chronically ill but in rather good nutritional state. The heart appeared enlarged toward both sides. The blood pressure was 155/98. The lungs were clear. There were no masses palpable within the abdomen. The electrocardiogram (done in routine three leads) showed evidence of myocardial changes, but not the typical picture of coronary disease (Dr. C. T. Chamberlain).

The red cell count was 2,760,000 with hemoglobin 52 per cent; white cell count 7,550 with neutrophils 61 per cent and lymphocytes 39 per cent. NPN 36 mg./per cent. Urinalysis was negative. The findings on gastric analysis were as follows (fasting specimen): free HCl none, total 50; the highest values reached following a test meal were free HCl 100, total 130.

A barium enema study revealed a spastic and irritated colon, but no evidence of an organic lesion within the large bowel. Studies of the upper gastro-intestinal tract showed a large hiatus hernia of the stomach and a short esophagus. A small ulcer was clearly demonstrable, located posteriorly at the junction of the esophagus with the herniated portion of the stomach. The intra-abdominal part of the stomach and the duodenum were normal in appearance. The patient was put on an ulcer regime and received large doses of vitamin B, iron, and liver preparations. Her condition improved steadily, and she was discharged after a hospital stay of three weeks. The last blood count before discharge revealed a hemoglobin of 84 per cent and a red cell count of 4,390,000. A check-up examination of the gastro-intestinal tract in April 1945 again showed the large hiatus hernia. The mucosal folds within the herniated portion of the stomach were swollen and widened. The ulcer had, however, disappeared.

#### COMMENT

The important characteristic common to all three of the cases reported above is that each seemed to typify a rather frequent clinical picture, and that the discovery of the hiatus hernia of the stomach came as an unexpected but satisfactory explanation of the condition. Case 1 gave a strong impression of cardiac disease; in Case 2 the

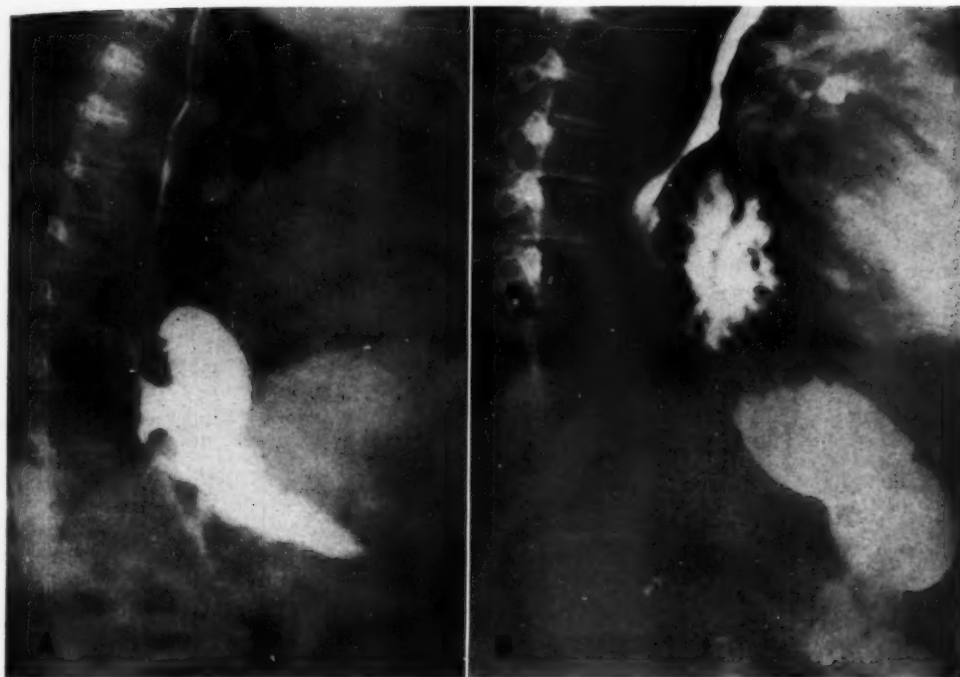


Fig. 4. Case 3. A. Large hiatus hernia of the stomach. The ulcer, located posteriorly at the junction of the esophagus with the herniated portion of the stomach, is clearly shown. Note constriction where the stomach passes through the muscular hiatus.

B. A check-up study, made sixteen months after the first examination, fails to reveal the ulcer previously found. The localized swelling of the mucosal folds within the herniated portion of the stomach is well shown.

history and age of the patient called for a diagnosis of a bleeding duodenal ulcer, while Case 3 was highly suggestive of a malignant neoplasm within the gastrointestinal tract.

The cause of bleeding in hiatus hernia is considered to be venous congestion in the herniated portion of the stomach due to muscular compression of the diaphragm (2, 9). The swollen and congested mucosal layer can easily be traumatized, with the production of superficial bleeding erosions or deeper ulcerations (3). The accompanying attacks of precordial pain found in Cases 1 and 3, suggesting an acute coronary occlusion or more chronic anginal seizures, have been observed by several authors (5, 7) and can well be attributed to the constriction of the herniated stomach by the diaphragm, combined with pressure upon the heart itself.

It may be noted that in the two patients

with substernal pain a moderate hypertension was found. The electrocardiogram, however, ruled out a recent myocardial infarction or coronary sclerosis sufficiently advanced to account for the attacks of precordial pain. A large ulcer could be demonstrated only in Case 3. This patient showed considerable hyperacidity and responded well to ulcer management.

We feel that the subsequent clinical course in these three patients has substantiated the diagnosis, but it is obvious that hiatus hernia can be established as a cause of intestinal bleeding and accompanying pain only if every other possible source of bleeding has been ruled out by a thorough clinical and x-ray study and continued observation of the patient.

#### SUMMARY

1. Hiatus hernia of the stomach can be a source of intestinal bleeding, manifesting

itself in hematemesis, melena, or microcytic anemia.

2. Three cases of this kind are presented and the etiology of the bleeding is discussed.

3. The symptoms of hiatus hernia may simulate coronary artery disease.

4. Other more commonly observed intra-abdominal conditions may be mimicked by hiatus hernia, requiring complete differential diagnostic studies.

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#### ADDENDUM

Since this paper has been completed an additional case of bleeding in hiatus hernia has been observed.

CASE 4. Mrs. A. R., white female, aged 48, gave a past history of no significance. For three years she had experienced almost daily attacks of substernal pain, aggravated by eating. Other complaints were frequent vomiting of bright red blood and "coffee-ground" material, occasional shortness of breath, and some loss of weight. Repeated examinations for pulmonary tuberculosis had been negative. The patient's condition had become suddenly worse during the last two or three weeks.

Physical examination on Jan. 3, 1946, was essentially negative, except for revealing some tenderness in the epigastrium. The blood pressure was 120/80. The red cell count was 4,390,000, with hemoglobin 90 per cent; white cell count 6,950. Gastric analysis (fasting specimen): free HCl 5, total 20. The highest values reached following a test meal were free HCl 24, total 46. The electrocardiogram (routine three leads) revealed no definite evidence of myocardial changes other than left axis deviation; normal sinus rhythm (Dr. C. T. Chamberlain).

X-ray examination demonstrated a hiatus hernia of the stomach, with a short esophagus, the herniated portion representing about one-third of the entire stomach. There were definite swelling and enlargement of the mucosal folds within the thoracic portion of the stomach but no evidence of an ulcer.

*Comment:* This case represents well the misleading history and the rather negative clinical findings in a patient with a hiatus hernia of the stomach. Some of the symptoms are quite suggestive of heart disease, while the repeated expectoration of bright red blood had led the patient to seek consultation for pulmonary tuberculosis.

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## Lymphoblastoma of the Kidney<sup>1</sup>

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THE GENERALIZED character of the lymphoblastoma group of diseases is well known. Involvement of the lymphatic system is most common, whereas invasion of the lungs, bones, nervous system, gastro-intestinal tract, and skin also is found frequently, particularly in the later stages of the diseases. Renal lesions of this type are recognized clinically less often than the others, although they are observed fairly frequently at autopsy.

In a clinical analysis of 196 proved cases of lymphosarcoma, Sugarbaker and Craver made no mention of kidney involvement, either as a primary focus or secondary invasion, although twenty-one other organs were listed as being secondarily involved. Barney, Hunter, and Mintz pointed out the paucity of references to the urologic aspects of the "radiosensitive tumors of the blood-forming organs" and described, among others, a case of lymphosarcoma with a grapefruit-sized mass in each loin which was the result of extensive infiltrations in the kidneys. According to these writers, such infiltrations can produce oliguria and uremia. Price described a case of unilateral lymphosarcoma of the kidney in a child with hematuria for four days at the onset of his illness; the involved kidney was removed and found to weigh 600 gm. In a case of acute lymphatic leukemia in a three-week-old infant, White and Burns found enlargement of the kidneys to four times their normal size. The nature of the enlargement presented a problem in diagnosis until the leukemic blood picture was discovered. Another report of a case of lymphatic leukemia which presented bilateral infiltrations of the kidneys with leukemic tissue is described in the Case Records of the Massachusetts General Hospital. Among 125 cases of Hodgkin's disease and

lymphosarcoma, Locke and Minot observed paroxysms of abdominal pain and hematuria in three cases, which they attributed to a urological manifestation of the disease. In these cases the external manifestations of the condition were not prominent. Chute discussed involvement of the urinary tract by "malignant lymphoma" and stressed the importance of diagnosis to avoid mistreatment. He stated that the signs and symptoms may simulate one of the more usual forms of kidney disease, or may be only of a general nature, but held that the diagnosis probably would be made if the condition were kept in mind.

According to Ewing, the kidney is a favorite site for metastases from lymphosarcoma, which may take the form of minute foci, diffuse infiltrations, or bulky masses. Baldrige and Awe found microscopic evidence of kidney involvement in 20 out of 39 cases of lymphoma, the highest incidence occurring in lymphocytic lymphoma with leukemia. On the other hand, Griffin and Brindley discovered 6 cases of lymphosarcoma among 3,865 cases at autopsy, none of which showed renal infiltration. In 4 out of 18 cases of leukemia, Merrill and Jackson found extensive gross and microscopic involvement of the kidneys. They pointed out the relationship of such infiltrations to the development of uremia in leukemia. It would seem that the leukemic forms of lymphoblastoma may be associated with a higher incidence of renal involvement.

Infiltration of the capsule of the kidney by lymphoblastoma may occur without extension into the parenchyma. Mathé described one such case wherein there was obliteration of the lower major calix on one side, giving the appearance of intrarenal tumor. Secrétan's case similarly showed thickening of the capsule on both sides by

<sup>1</sup> From the Department of Pathology, University of Texas, Galveston. Accepted for publication in May 1945.





Fig. 1. Intravenous pyelogram. The left side is best visualized and reveals the enlargement and elongation of the pelvis and calices. The superior major calix is well shown and appears elongated and somewhat narrowed. Only a stump of the middle calix is seen.

tumor, with no parenchymal invasion. The left pyelogram was said to show elongation of the pelvis and calices, consistent with the appearance of polycystic kidneys; the right pyelogram was normal. No explanation was offered for this difference in appearance nor for the production of the pelvic and caliceal elongation.

The case to be reported is one of unusual interest, not only because of the presence of massively enlarged kidneys in a case of lymphosarcoma, but because the pyelographic studies revealed a similarity to polycystic kidneys. We have been unable to find a similar case in the literature.

#### CASE REPORT

A. P., a 17-year-old white male, was admitted to the John Sealy Hospital on May 4, 1944. He had been well until five months previously, at which time he had a cold accompanied by cough and whitish sputum and diffuse joint pains, which had persisted. Three months before admission he observed bilateral swelling about the angles of the jaw; at the same time there was persistent abdominal pain. For a month prior to admission he had complained of

parietal and occipital headaches, nocturia, and polyuria, as well as intermittent deafness of the right ear. For three weeks there had been afternoon temperature elevations and, for a week, bleeding from the gums.

The patient was a well developed boy who appeared chronically ill. There were large, firm, rubbery and discrete lymph nodes in the occipital, anterior cervical, submaxillary, axillary, and inguinal regions. The blood pressure was 128/78,

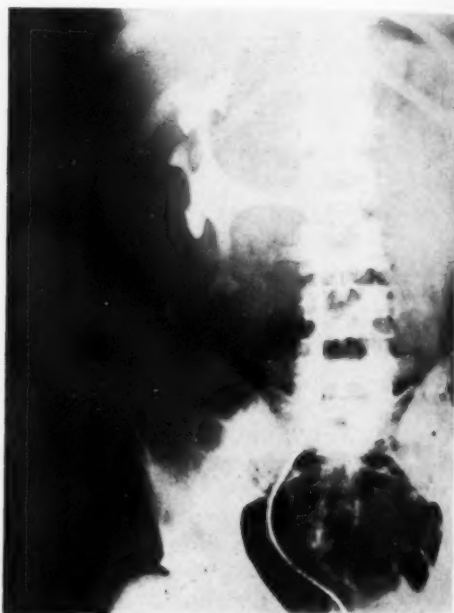


Fig. 2. Retrograde pyelogram of the right kidney. The pelvis is elongated transversely and enlarged. The superior and inferior major calices show considerable elongation, and the superior one is somewhat narrowed. The arc-shaped lateral border of the middle calix is shown.

and there was a systolic murmur at the aortic area. The abdomen was enlarged and the flanks bulged; the liver and spleen could not be felt. There was a large mass in the upper abdomen on either side, each measuring approximately 10 × 6 × 6 inches. These masses appeared to be retroperitoneal and did not move with respiration.

Repeated examination of the blood showed increasing anemia and thrombocytopenia. The leukocyte count varied from 9,900 to 14,450 per c. mm. before irradiation, and 4,000 to 13,000 after irradiation. There were about 50 per cent lymphocytes, as well as "lymphosarcoma cells," in the blood smear. The non-protein-nitrogen level was consistently elevated, varying from 66 to 93 mg. per cent. The urine contained slight amounts of albumin and concentrated to a maximum specific

gravity of 1.016; there were no erythrocytes or leukocytes in the urinary sediment. A sternal biopsy revealed a hyperplastic marrow with extensive lymphosarcomatous infiltration. The pathologic diagnosis upon biopsy of a lymph node was "lymphoblastoma." The cells showed numerous mitoses and there was invasion of the capsule.

A flat film on May 15, 1944, showed a diffuse homogeneous area of density obscuring the upper part of the abdomen. This area had a rounded lower border and it appeared to extend below the level of the crests of the ilium on each side. Following the injection of 30 c.c. of 35 per cent diodrast, there was poor excretion on the right side, with only small amounts faintly visible in some of the calices. On the left side (Fig. 1) the pelvis was elongated transversely and somewhat enlarged. The superior and inferior major calices were considerably elongated and the superior calix was narrowed as well. Only a stump of the middle calix was seen. The minor calices were curved and failed to show their normal cupping. The upper ureter was displaced medially over the third and fourth lumbar vertebral bodies.

A retrograde pyelogram was made on the right side one week later (Fig. 2). The appearance was essentially the same as on the left side. The superior and inferior calices were lengthened. The middle calix was short and broad and its minor calices showed no cupping. The lateral border of these minor calices was arc-shaped.

Radiotherapy was administered, 12.5 r in air being given on three alternate days at a focal-skin distance of 100 cm. This treatment was discontinued because of leukopenia, but had resulted in subjective improvement for about a week. In spite of repeated transfusions, the anemia and hemorrhagic tendency persisted and the patient expired six months after onset of his illness.

**Pathologic Report:** There were 1,500 c.c. of clear yellow fluid in the abdominal cavity, and 500 c.c. in each thoracic cavity. The serosal surfaces were flecked with petechial hemorrhages. The abdominal organs were displaced downward by the enlarged kidneys. The liver was enlarged, weighing 2,360 gm., and revealed a firm grayish parenchyma. The spleen weighed 500 gm. and had scattered areas of recent infarction. There were varicosities of the esophageal veins and one had ruptured recently. There was enlargement of the mediastinal, periaortic, axillary, inguinal, and cervical lymph nodes. The lungs were congested, with hypostatic pneumonia at the bases. The heart weighed 340 gm., and the myocardium was soft and pale. Both kidneys were enormously enlarged, measuring approximately  $25 \times 15 \times 15$  cm.; the right one weighed 2,320 gm., and the left 2,450 gm. Their surfaces were reddish and smooth; the cut surfaces revealed a homogeneous reddish parenchyma with distortion and elongation of the pelvis and calices (Fig. 3).



Fig. 3. Right kidney in cross section. This kidney weighed 2,320 gm. In the fresh state the surface was reddish, due to numerous hemorrhages. The compression and elongation of the calices due to extensive invasion by lymphosarcomatous tissue are evident.

Microscopic examination revealed a lymphocytic infiltration of the liver, spleen, prostate, testes, thyroid, hypophysis, and lymph nodes. The lymph nodes were entirely replaced by lymphocytes with mature nuclei and scant cytoplasm. The kidneys showed a wide separation of the degenerated tubules and glomeruli; the intervening stroma was densely infiltrated with lymphocytes. In many areas there were disintegration of the capillary walls and considerable hemorrhage.

#### DISCUSSION

The clinical picture of bilaterally enlarged kidneys and moderate azotemia, together with the suggestive roentgen appearance, was considered to be strong evidence in favor of a diagnosis of polycystic disease of the kidneys. It is worth noting that intravenous pyelography was done in spite of a non-protein-nitrogen level in the blood of almost three times the normal value, and a satisfactory filling of the pelvis and calices on the left side was obtained. With a proved diagnosis of lymphosarcoma by lymph node and sternal biopsy, lymphosarcomatous infiltration of the kidneys had to be considered in an attempt to explain the clinical observations. It was generally considered, however, that the pyelograms were more consistent with the appearance of polycystic kidneys, particularly since such an appearance had not been described previously in a case of lymphoblastoma of the kidney.

It is well known that tumors of the kid-

ney may produce a pyelographic appearance resembling polycystic kidneys. The calices are elongated and narrowed in either case, but when due to tumor this compression usually is greater, with the result that they may be attenuated to fine linear streaks. This is the so-called "spider-leg" deformity. Moreover, in the case of tumors, the distal portions of the calices show a distinct tendency toward dilatation (Caulk). In polycystic kidneys, however, there are arc-shaped depressions of many of the calices and even the pelves are elongated in a superoinferior direction (Kerr and Gillies). As a rule, there is little difficulty in differentiation, since polycystic disease of the kidney is nearly always bilateral, whereas neoplasms of the kidney usually are unilateral (Beilin and Neiman).

Taking into account these criteria of the radiologic diagnosis, one can perceive that the roentgenograms in this case presented features of both polycystic disease and tumor invasion, although not typical of either condition. Apparently the presence of cysts or of masses of lymphosarcomatous tissue may produce similar distortion of the calices.

It is suggested that in cases of bilateral kidney enlargement lymphoblastomatous involvement be considered in the differential diagnosis. A pyelographic appearance simulating bilateral tumor or polycystic disease may be viewed as suggestive evidence, while a positive lymph node biopsy or a leukemic blood picture can be considered as further confirmation.

#### SUMMARY

1. Lymphoblastoma of the kidney is an infrequent clinical diagnosis. It is a common finding in pathologic material and would seem to occur more often in cases with a leukemic blood picture.

2. Primary lymphosarcoma of the kidney is a doubtful entity, since enlargement of the retroperitoneal nodes usually is present as well.

3. Lymphoblastomatous infiltration of the capsule may produce a filling defect in

the pyelogram resembling a parenchymal lesion.

4. A case of lymphosarcoma with infiltration of the kidneys is reported. The pyelograms bore some resemblance to polycystic disease or bilateral tumor, and a definite antemortem diagnosis could not be established.

5. When lymphoblastoma is considered in the differential diagnosis of bilateral kidney enlargement, the pyelographic appearance and leukemic blood picture are of aid in arriving at the diagnosis.

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## Paragonimus Westermanii: A Case Report<sup>1</sup>

CAPT. THOMAS H. BREM, M.C., A.U.S., and CAPT. HAROLD A. COHN, M.C., A.U.S.

INFESTATION with the trematode *Paragonimus westermanii* (or lung fluke) is said to be of common occurrence in China, Japan, Formosa, and the Philippines, where it is the cause of "endemic hemoptysis." In our own experience with approximately 20,000 Chinese hospital admissions, the disease has been observed but once, although we have been well aware of the condition and have made repeated wet-mount sputum examinations in patients with unexplained hemoptysis.

The disease is contracted by ingestion of the fresh-water crab or crayfish, which harbors the larval form. The larvae promptly develop and make their way through the intestinal wall into the peritoneal cavity, and thence through the diaphragm, into the lung parenchyma, where they become encysted and produce symptoms. These flukes may be found in other viscera as well, even the brain, but the lung is the site of predilection. Ova are produced in large numbers and coughed up in sputum which is characteristically mucoid and rusty, not unlike that seen in pneumococcus pneumonia.

The fluke is described as thick and fleshy, oval in shape, and measuring 8 to 20 mm. in length by 5 to 9 mm. in breadth. In pathologic specimens tumor-like swellings are seen throughout the lung, mostly peripheral and outlined beneath the pleura. The parasites are contained within these nodules. Sections of the lung reveal scattered areas of infiltration, in which are "burrow-like" cavities containing the flukes. These smaller channels may coalesce to form a larger cavity with bronchial communication.

### CASE REPORT

A 28-year-old Chinese soldier was admitted to the hospital on Sept. 22, 1943, because of coughing up

blood. During the previous three or four years there had been frequent episodes of hemoptysis, with production of large amounts of blood especially during or after strenuous physical exertion. At times there were sharp pains in both sides of the chest, not noticeably associated with respiration. There had been shortness of breath on exertion and some loss of weight in the preceding two months, during which hemoptysis had been continuous. The patient had not felt feverish nor had there been night sweats. There was no history of bleeding from other orifices.

The patient had been in the army one year. Prior to that he had spent his whole life in Szechuan Province. He had never lived on, or even been near, any large body of water and could not remember having eaten crabs, crayfish, or any other shellfish. His mother and grandmother were said to have been chronic blood spitters; his father had died with generalized swelling, and he had two siblings, both of whom were healthy with no history of hemoptysis.

The patient was well developed and fairly well nourished. His temperature was 97.8° F., and his blood pressure 108 systolic and 68 diastolic. The mucous membranes were of fairly good color and no icterus was present. Eyes, nose, and throat were normal. There was no enlargement of the peripheral lymph nodes. The trachea was in the mid-line. Both sides of the chest moved well, equally and synchronously on inspiration. The percussion note was normally resonant, and the breath sounds were normal. No adventitious sounds were audible. The heart was not enlarged, the rate was moderate, and the rhythm regular. Heart sounds were of normal character and no murmurs were present. The abdomen was soft and not tender. The spleen was plainly palpable, firm but not tender, just below the left costal margin. Liver and kidneys were not felt. Genitalia and extremities were negative, and no abnormal neurological signs were found.

The white blood count was 8,000 with 44 per cent polymorphonuclears, 12 per cent eosinophils, 42 per cent lymphocytes, and 2 per cent monocytes.

Urine was negative, but the stool contained many *Ascaris* and occasional *Trichuris trichiura* ova.

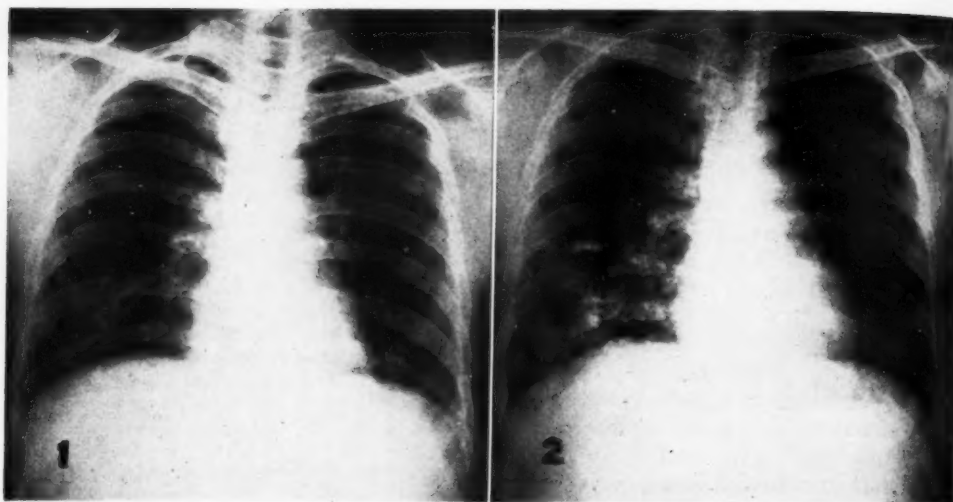
The sputum was rather copious, mucoid in character, containing reddish brown clots of blood. The wet mount revealed red cells, pus cells, and epithelial cells. No acid-fast bacilli were found.

The chest film at the time of admission showed exaggeration of the right basal truncal markings, but nothing more.

The course was afebrile, and the patient at no time appeared to be ill. He continued to cough up large quantities of mucopurulent sputum containing

<sup>1</sup> Accepted for publication in May 1945.





Figs. 1 and 2. Roentgenograms made Oct. 20, one month after admission, and Nov. 19, following administration of lipiodol. For description, see text.

masses of dark brown blood. Accordingly, bronchoscopic examination was performed, with the idea of a bronchial papilloma in mind. The bronchoscopist's<sup>2</sup> report read: "Larynx, trachea, and carina normal. Left bronchial tree normal. Mucosa on medial wall of right main bronchus redundant and granular just opposite the orifice of the right upper lobe bronchus. Remainder of right bronchial tree normal. No bleeding."

A few days later a stool specimen was sent to the laboratory. Fortuitously the patient had expectorated into the specimen cup, and on making the mount for the examination, this bloody mucoid material was used. Unexpectedly a large number of unfamiliar ova were seen, which soon were identified as those of *Paragonimus westermani*.

The diagnosis thus accidentally being established, the problem of treatment remained. A rough egg count was done daily by emulsifying the sputum in an equal amount of saline and examining a drop under a coverslip through the microscope. The daily count averaged 25 to 30 ova per coverslip, but occasionally a single low-power field contained that number.

The patient was given a five-day course of emetine hydrochloride, 32 mg. twice daily administered intramuscularly. No diminution in the number of ova produced was noted.

Thereupon, as a therapeutic as well as diagnostic measure, lipiodol was instilled into the bronchi. No roentgenologic abnormalities were demonstrable initially, and the output of ova was not reduced.

A second course of emetine was administered, this time covering seven days, but with no effect. Fi-

nally neosarsphenamine, 0.45 gm., was given intravenously. Concomitantly there was a fall in the egg count to an average of 8 per coverslip. A second injection caused no further reduction, and a few days later the count began to rise until new highs were reached, on one examination 600.

We had hoped to try other drugs, especially antimonials, but none were then available. Inasmuch as the patient apparently suffered no constitutional effects from his infestation, he was discharged to duty on Dec. 21, 1943, three months after his admission.

*Roentgen Study of the Chest:* The initial film of the chest showed only some exaggeration of the right basal bronchovascular markings with otherwise clear lung fields. Subsequent films showed a progressive coarsening and coalescence of these markings, producing a diffuse zone of infiltration at the right base which became most marked about a month after admission (Fig. 1). A review of the films showed a persistent radiolucent area within this zone simulating a cavity. A later study showed some clearing of the infiltration, but a radiolucent channel was still seen, suggesting a "burrow" cavity. No infiltration was ever identified in the remainder of the lung fields.

Lipiodol filling of the right middle and lower lobes showed what was interpreted as a normal bronchial tree. In subsequent films showing residual lipiodol in the alveoli, a persistent dense globular collection was noted in the approximate location of the previously identified cavity. This measured 5 to 8 mm. in diameter and was surrounded by a radiolucent zone (Fig. 2). Though its significance may be disputed, we think it might represent a collection within a "burrow" channel or even a collection of lipiodol about the fluke.

<sup>2</sup> Capt. A. S. Churchill, M.C.



## COMMENT

Many of our Chinese patients with unexplained hemoptysis showed chest films with coarsened basal pulmonary truncal markings, often associated with infiltration of a non-specific nature similar to that shown here. Parasitic infestation was often suspected, but in only this one case was there positive laboratory confirmation. Our x-ray findings correspond to those described and expected from pathologic studies. The almost negative chest picture on admission, in spite of an acute clinical episode of hemoptysis for two months followed

by a progressive infiltrative lesion while in the hospital, is a matter of interest and speculation. The recommended therapeutic measures were ineffectual.

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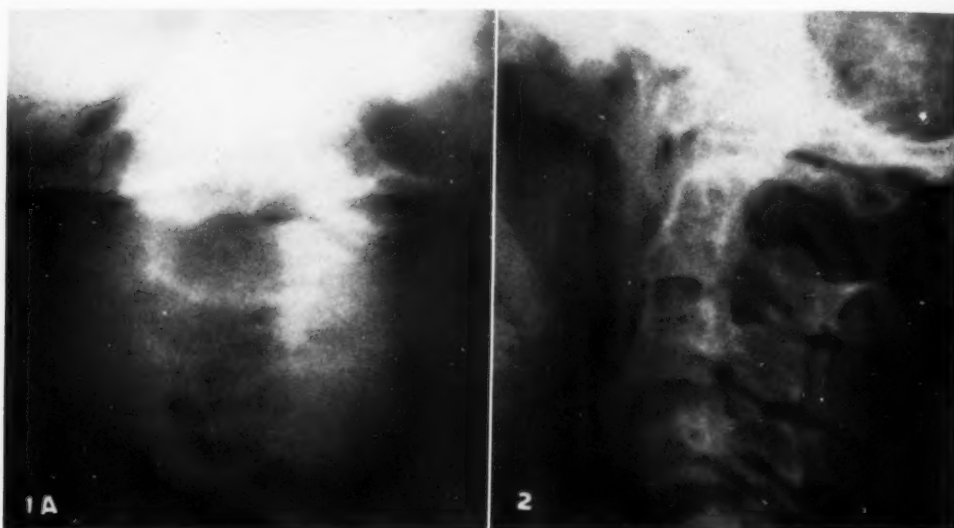


## Two Cases of Spinal Anomaly, Best Demonstrated by Laminagraphy<sup>1</sup>

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**O**CCASIONAL mention of hemivertebra is made in the radiological literature. The anomaly is not rare, having been found in the lumbar spine in 3 per cent of 3,000 spines examined by Brailsford. In this Army General Hospital, hemivertebra

In spite of the relatively frequent occurrence of this anomaly, the two cases reported here seem well worth attention: the first because of the fact that no case of hemi-atlas was found in a search of what literature was available to us; the second



Figs. 1-2. Case 1. Figure 1A is an anteroposterior laminagraphic study, showing the anomalous development of the cervical region. The findings are shown diagrammatically in Figure 1B. Figure 2 is a conventional lateral view showing the close relationship of the first cervical segment to the occiput.

because extensive maldevelopment of the spine was present with little clinical evidence. It is worthy of note that in neither case was conventional roentgenography sufficient to show the nature of the anomaly present. In both instances laminagraphy led to a clarification of the picture.

The first patient was a white male, aged 21, who entered Sept. 11, 1944, because of pain in the neck for two weeks. Several weeks earlier, he had been struck in the back of the neck during routine boxing for physical conditioning. He experienced

was demonstrated in 2 of 376 (0.5 per cent) examinations of the cervical spine, in 1 of 556 (0.2 per cent) examinations of the thoracic spine, and in 1 of 2,025 (0.05 per cent) examinations of the lumbar spine.

<sup>1</sup> Accepted for publication in May 1945.

immediate pain and gradually increasing tenderness of the cervical muscles, especially on the left, with some limitation of motion. Physical examination showed the head and neck to be held rigid as a protective mechanism. There were tenderness and limitation of all extreme motions of the neck, and especially of rotation. No deformity was present. There was no radiating pain. Routine laboratory studies were normal. Conventional studies of the cervical spine failed to demonstrate the anomaly. Therefore, laminagraphic study was made, with the findings illustrated in Figures 1-3. These were interpreted as an assimilation of the atlas in the occiput with a supernumerary hemi-atlas on the left (strictly speaking, this partial vertebra consists of a lateral mass only). Bed rest and leather traction for fourteen days led to relief of symptoms, but the patient was eventually discharged.

The second patient was a 32-year-old white man who had complained of cough and expectoration for five to six years. In the course of routine studies, including chest films and bronchography, a dextrocardia and thoracic deformity were discovered. On subsequent questioning, the patient stated that his right shoulder had been higher than the left since childhood. When about eight years old, he had tried to help his father, an ice man, with his duties but had been forced to stop because of backache. He was forced to discontinue employment in an aircraft factory for the same reason, although his employment required only the use of a rather cramped posture. He had lumbar pain on lifting heavy objects at the time of the present observation. On physical examination of the skeletal system the right shoulder was found to be slightly elevated. There was a sharp scoliosis to the right in the upper thoracic region. The right sternocleidomastoid muscle was more developed than the left. The right sternoclavicular joint was normal in position; the left was about an inch lower and appeared enlarged. The right anterior chest was slightly more prominent than the left. Other findings

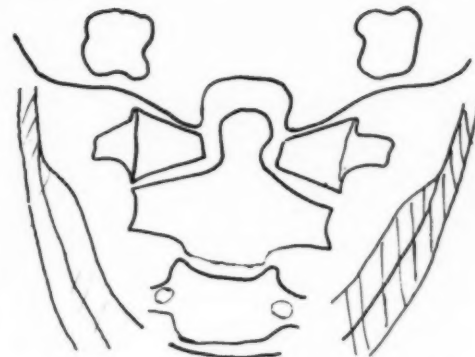
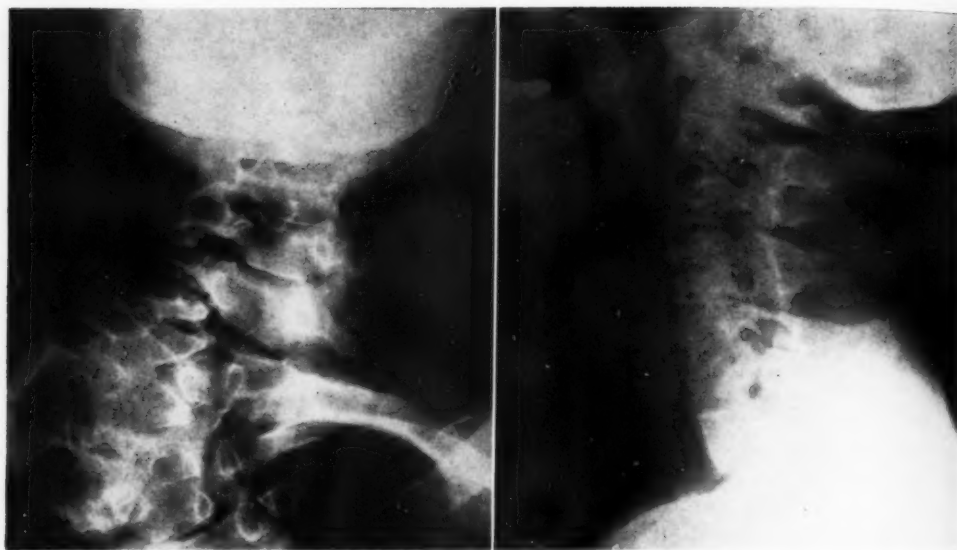


Fig. 3. Case 1. Normal laminagraphic study of the upper cervical region with illustrative line drawing, for comparison.

were those of an acquired dextrocardia, thought to be attributable to the thoracic deformity.

X-ray examination (Figs. 4-6) showed fusion of the posterior elements of the 4th, 5th, 6th, and 7th cervical vertebrae on the right and of the posterior elements of the 5th and 6th vertebrae on the left. The right elements were incompletely formed, suggesting partial hemivertebrae. There was incomplete closure of the laminae of



Figs. 4 and 5. Case 2. Conventional studies.

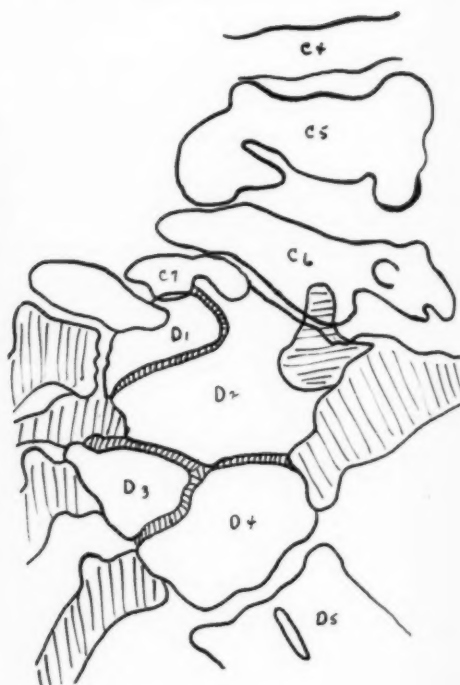


Fig. 6. Case 2. Laminagraphic study and illustrative line drawing.

C-6. There was absence of the first and third ribs and portions of the corresponding vertebrae, resulting in two left hemivertebrae, each with a normal rib. The second and fourth thoracic vertebrae were almost completely fused with the hemivertebra corresponding to the third vertebra. The second and fourth ribs were fused on the left just distal to the spinal attachment, forming a rib larger than usual occupying the normal position of the third rib. There were only 10 ribs on the left, 12 on the right. The asymmetry of the structures produced a marked localized scoliosis in the upper thoracic spine. These findings were not significantly related to the initial com-

plaint and were the cause of only slight and indefinite symptoms.

The findings in each of the two cases recorded depend largely on laminagraphic examination for their demonstration, and it may be that the rarity of hemivertebra of the atlas is merely an expression of the technical difficulties of the demonstration of this anomaly. In the second case the marked anomalous variations were not very clearly outlined by conventional studies, but a laminagraphic examination led to clarification of the situation.

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## Spontaneous Renocolic Fistula: Report of a Case<sup>1</sup>

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A FISTULOUS communication between the kidney and colon constitutes an exceedingly rare clinical entity, being referred to only casually in the average textbook of urology. Despite the fact that Hippocrates first made mention of this condition, Mertz (1), in 1931, succeeded in collecting only 26 cases over the intervening centuries. Since the excellent clinical and anatomical review of the subject by Vermooten and McKeown (2), 12 additional cases have appeared in the literature. The most recent, and by far the most unique, recorded by Markowitz and Katz (3), was a fistulous connection between the lower pole of a double kidney and the colon. Careful analysis of the literature does not tend to indicate an increased frequency of occurrence, but rather an earlier recognition of chronic kidney disease by improved diagnostic procedures and proper surgical management.

The first thorough investigation of renocolic fistula was done by Rayer (4), who believed that a chronic infection of the kidney produced the initial lesion, the adjacent colon becoming attached by fibrous adhesions with subsequent ulceration and fistula formation. To date, no instance of the condition has been reported as a result of a primary bowel lesion. The investigations of Wesson (5), Ratliff and Barnes (6), and Higgins and Hicken (7), show fistula formation to be incident to a chronic suppurative process of the kidney with an associated perinephritis or perinephric abscess. Ratliff also points out that tuberculosis was the least frequently encountered causative agent, occurring only five times in 37 cases reviewed, while renal calculi accounted for 14 cases and 18 were collectively listed as of inflammatory origin.

The outstanding symptoms of renocolic fistula are chills and fever, renal colic, and tumor in the flank, which disappears with

dramatic suddenness following perforation and evacuation of pus into the bowel. Except in a few of the early cases which were discovered at necropsy, the diagnosis has been made by urographic methods. Hirsch and Bass (8) are of the opinion that the lesion may go undiagnosed unless retrograde studies are made. Wesson (5) and Feldman (9) have each diagnosed a case with the aid of a barium enema.

### CASE HISTORY

A 42-year-old Austrian-born housewife was admitted to the hospital because of intermittent pain in the chest. Approximately nine months prior to admission, without preceding injury, she experienced a dull aching pain in the lower left chest, which was not aggravated by deep breathing. She denied cough, hemoptysis, or dyspnea, but gave a history of associated high fever with chills and night sweats.

A local physician treated her for "pleurisy," and the symptoms gradually subsided. A month later, the pain recurred, but in a more disabling manner, and failed to respond to the therapeutic measures previously administered. One evening a diarrhea developed, which was followed by marked weakness and the patient fainted. When she regained consciousness, the pain had subsided and she was able to perform limited household duties the following day. Her general condition steadily improved and she gained a little weight. Several months later, a series of "boils" appeared over her body, and these were followed by an osteomyelitis in the distal shaft of the left radius. Treatment by incision and drainage brought about resolution of the process, but with some residual stiffness of the fingers and limitation of flexion at the wrist.

Because of a return of the old chest complaint and two weeks of chills and fever with associated severe night sweats, the patient reported to the Outpatient Department for treatment. A chest film showed a suspicious infiltration in the left apex and it was felt advisable to admit her for observation.

The general appearance of the patient was that of a chronically ill and rather poorly nourished middle-aged woman. Her temperature was 101.8° F., pulse 120, respirations 24. The red blood cell count was 4,600,000, with 11.5 gm. of hemoglobin; the white cell count was 6,000, with a normal differential count. The urine showed albumin 1+, with 25 red cells per high-power field, but was otherwise negative. Physical examination was not particularly revealing except for a soft blowing systolic murmur

<sup>1</sup> Accepted for publication in May 1945.

at the cardiac apex; the lungs were clear throughout to auscultation and percussion. The abdomen was soft, and the lower pole of the right kidney was easily palpated but not tender. No bulge was detected in either flank, but there was slight tenderness on deep palpation in the left flank. Because of the previous osteomyelitis, together with the physical and laboratory findings, an infection in or about the left kidney was suspected and intravenous pyelography was done.



Fig. 1. Retrograde pyelogram demonstrating free communication between the upper calix of the left kidney and a short segment of bowel.

The urogram revealed a normally shaped but ptotic right kidney with good function and normal architecture. The left kidney was somewhat smaller than the right and excreted the media to a limited degree; the calices appeared distorted, and a fine granular type of calcification clearly outlined the lower pole. The psoas margins were smooth and without defect. A tuberculous left kidney was suspected and retrograde pyelograms were then made to aid in evaluation of the excretory urograms.

Cystoscopy revealed no gross abnormality of the urinary bladder. The right ureteral orifice was normal, but the left showed an efflux of purulent material which prevented free drainage. The P.S.P. test was normal on the right but showed marked delay on the left. Bladder urine was negative for tubercle bacilli or other organisms. Twenty-five red cells were present, with only an occasional white cell.

Ureteral catheters were easily passed to each kidney pelvis and contrast medium was instilled in the usual manner, though the operator did notice that the solution was injected into the left catheter with greater ease than on the right. Thinking that perhaps there was an escape of the medium about the catheter, he accordingly doubled the amount with-



Fig. 2. Second roentgenogram, made after instillation of an additional 75 c.c. of medium, clearly outlining the caliceal defect and free communication with the descending colon.

out discomfort to the patient, and the first roentgenogram was taken (Fig. 1). The generalized distortion of the calices of the left kidney is clearly shown with an extravasation of the medium outlining what appeared to be a short segment of bowel. An additional 75 c.c. of dye was then injected, and the second roentgenogram clearly outlined a long segment of colon distal to the splenic flexure (Fig. 2). A barium enema, given in an effort to visualize the fistulous communication, failed to demonstrate any defect or regurgitation into the kidney, thus indicating that the flow was in one direction only (Fig. 3).

In the interval since admission, repeated chest roentgenograms had shown no essential change in the fine linear infiltration in the left apex of the lung, and frequent sputa examinations were negative for tubercle bacilli.

A transverse colostomy was performed to divert the fecal stream. One month later, a small left kidney was exposed through a routine renal incision. An abscess measuring 5 cm. in diameter was located between the kidney and the adjacent lumbar musculature, with a second abscess, 8 cm. in diameter, between the diaphragm and perirenal fat. Each was filled with a mixture of blood and purulent material which had no odor. Because of the dense adhesions encountered about the renal bed, it was not until the kidney was removed that the defect in the superior pole, suggested by the pyelograms, was revealed. A 5-mm. opening was rather easily located in the descending colon about 8 cm. distal to the splenic flexure and was closed with a single purse-string su-



Fig. 3. Barium enema study, showing failure to define any marginal defect of the colon or reflux of barium into the kidney.

ture. The colostomy was subsequently closed without sequelae.

Postoperatively, multiple sinus tracts developed in the incision and a large abscess cavity in the kidney bed was evacuated, with prompt cessation of drainage and spontaneous closure of the sinuses. Of the frequent gastric washings cultured, one specimen, on the 55th day, eventually proved positive for the presence of tubercle bacilli. There was, however, no appreciable alteration of the linear infiltration in the left apex during the period of hospitalization.

#### SUMMARY

1. The literature of renocolic fistula has been briefly reviewed and a case of tuberculous etiology reported.

2. Fistulous communication between a kidney and the colon is incident to a long-standing suppurative renal process with associated perinephritis and perinephric abscess formation.

3. Primary bowel lesions have not accounted for any of the cases reported in the literature.

4. Early recognition of chronic renal disease by urographic studies, especially by retrograde methods, has accounted for an appreciable reduction in the incidence of renocolic fistulae.

5. Treatment consists of nephrectomy and closure of the fistula in the bowel.

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# EDITORIAL

## Radiology and Atomic Power

At the observance by the American College of Radiology, on Nov. 8, 1945, of the fiftieth anniversary of the discovery of x-rays, Dr. Robert S. Stone spoke, appropriately enough, on "Radiology from Roentgen to the Era of Atomic Power." Already this address has appeared in a number of medical publications<sup>1</sup> and it will undoubtedly be reprinted in others. While it will not be published in this journal, so great is its significance for radiologists that not at least to call attention to it in these pages would be a serious editorial oversight.

As Dr. Stone points out, the discovery of radioactivity was fundamental in that it revolutionized man's idea of the structure of the universe. Prior to that discovery, the atom of any given substance was considered to be indivisible and immutable. Now certain atoms were found to be breaking up and, in the process, producing atoms of other elements. Thus from an atom of radium there is given off a small particle which forms the nucleus of a helium atom, while the larger part remaining constitutes the nucleus of the atom of radon. It was discovered, also, that the emitted particle was possessed of energy which could be effectively used to bombard other atoms and effect their transmutation. Continued experimentation finally established the fact that the atom is made up of a central nucleus—itsself composed of protons and neutrons—surrounded by electrons, and that, except in the case of hydrogen, it can be broken up by appropriate methods.

In 1939 a new type of reaction was discovered. It was found that if one of the three known isotopes of uranium were

bombarded with neutrons, some of the atoms burst apart into two completely different atoms of about equal weight but the combined weight of the newly formed atoms was less than that of the parent uranium atom. This phenomenon, known as "fission," is accompanied by the freeing of a vast amount of energy—equal to the mass lost multiplied by the square of the velocity of light. Moreover, the neutrons released by fission of one atom may be captured by other uranium atoms, which themselves divide, giving off more energy and neutrons in a so-called chain-reaction. One outcome of this was the controlled chain-reacting pile; another was the large-scale atom splitting, whose tremendous potentialities for destruction were demonstrated in the last days of the war.

For the physician and biologist these chain reactions are of interest from a wholly different point of view, for they have a constructive aspect which, if less spectacular than the destructive, may be equally significant. As Dr. Stone points out, they can provide, on a scale hitherto unapproached:

1. An abundant supply of the particular radioactive isotopes formed in the fission process.
2. A supply of such other radioelements as can be made by bombardment with neutrons of the energies available.
3. A source of slow neutrons.
4. A source of fast neutrons.

The changes that these newly available tools will produce in medical procedure cannot be foretold. Some fields in which they have already been used with promising

<sup>1</sup> For example, *Am. J. Digest. Dis.* 12: ix, December 1945; *Mississippi Valley M. J.* 68: 13, January 1946.

results, though necessarily to a limited extent, are mentioned by Dr. Stone. These include metabolic studies, pharmacological research, diagnostic procedures with radioactive materials, and the treatment of disease.

Radioactive phosphorus and certain non-radioactive isotopes have been used with conspicuous success in determining the mechanism of many complex steps in metabolism, offering a hope of greater understanding of basic life processes. The use of very short-lived carbon isotopes has already advanced the knowledge of photosynthesis and, now that these will be available in larger quantities, the possibilities for further studies are greatly increased.

The use of radiphosphorus in the treatment of leukemia is well established, and promising results have been obtained in a series of cases of advanced cancer with fast neutrons. Radiostrontium has been shown to concentrate in growing osseous tissue, and its possibilities as a therapeutic agent in bone neoplasms and other diseases have been the subject of limited investigations. Similarly radio-iodine is selectively accumulated in the thyroids of patients with hyperthyroidism and has produced promising results in some cases of that condition. With the increased availability of radioactive materials, all these and many other lines of research are released from limitations to which they have hitherto been subject.

New fields of investigation are also opened up. The possibility that some chemical may be found which will lodge

selectively in malignant cells is one of the hopes of the future. If to such a chemical there could be attached a radio-element, a great stride might be made toward the effective treatment of cancer. Still another possibility is that of using certain radioactive materials created through the use of the chain-reacting piles for the development of treatment bombs with a content of curies more than tenfold that of the present day radium bomb.

"It is apparent," concludes Dr. Stone, "that the age of nuclear energy was already here and being used by the medical profession before a chain-reacting pile was started. The science of nuclear change started when Becquerel was stimulated by the work of Roentgen. The discovery of radium by the Curies provided the first source of nuclear energy for medical and biological uses. The discovery of the phenomena of artificial radioactivity widened the field and the discovery of the cyclotron was a great stimulus to its advance because it increased the number and quantity of available radio-elements. Now the atomic power machines, by which is meant those machines utilizing the energy from fission to keep them in operation, have again expanded in an unlimited way the possibility for usefulness in research and therapy by radioactive isotopes.

"A new age has begun for medicine . . . The pioneering spirit of those physicians who created the specialty of radiology under the stimulus of Roentgen's discovery must enter into their professional descendants and their fellow physicians so that medicine will advance into new fields."



## ANNOUNCEMENTS AND BOOK REVIEWS

### AMERICAN BOARD OF RADIOLOGY EXAMINATIONS

The American Board of Radiology will conduct examinations at the Palmer House, Chicago, Nov. 27 to Dec. 1, 1946. This will be the only examination held during 1946. All those wishing to appear before the Board at this time must have their applications on file by Sept. 1, 1946.

B. R. KIRKLIN, M.D.  
*Mayo Clinic, Rochester, Minn.*

### ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

The Mid-Summer Conference of the Rocky Mountain Radiological Society will be held on Aug. 8, 9, and 10, 1946, in Denver, Colorado, at the Shirley Savoy Hotel.

### AMERICAN SOCIETY OF X-RAY TECHNICIANS

The American Society of X-Ray Technicians will hold their eighteenth convention at the Hotel Jefferson in St. Louis, Mo., June 10 to 14, 1946.

### LEGION OF MERIT AWARDED TO DR. ROBERT S. STONE

Dr. Robert S. Stone of the University of California, more recently serving as visiting professor at the University of Chicago, was one of five distinguished scientists from the latter institution to be awarded the Legion of Merit for services in connection with the Atomic Bomb Project. The citation acknowledging Dr. Stone's services reads:

"As Chief of the Health Division of the MED project, for the Manhattan Engineer District, Army Service Forces, he was in charge of essential research and investigations of the radiation hazards involved in the operation of the entire project. A noted radiologist, Dr. Stone's sound scientific judgment, his initiative and resourcefulness, and his unselfish and unswerving devotion to duty have contributed vitally to the success of the Atomic Bomb Project."

### LEGION OF MERIT AWARDED TO MAJ. MILTON FRIEDMAN

Major Milton Friedman of New York City, who from May 1942 to January 1946 was Chief of the Radiation Therapy Service at the Walter Reed General Hospital, has been awarded the Legion of Merit. The citation commended Major Friedman's services, "rendered with unselfish devotion to the welfare of the sick and wounded," and specially mentioned his invention of new and improved instruments and technics for the treatment of malignant growths.

### W. H. MCGUFFIN, M.D., LL.D.

At a special medical convocation of the University of Western Ontario on March 27, 1946, Dr. W. H. McGuffin, who graduated from the University in 1910, was honored with the degree of Doctor of Laws. In conferring the degree, Dr. G. E. Hall, Dean of the Medical School, said: "Dr. McGuffin has been an example to our students and a typical alumnus who has directly and indirectly advanced the interests of the whole university."

On the same occasion Dr. McGuffin personally presented the W. H. McGuffin Prize in Radiology, which he endowed in 1939, to Donald Bruce Ferguson, one of the 36 students receiving the degree of Doctor of Medicine.

## Letter to the Editor

### HOSPITAL FLUOROPHOTOGRAPHY ITS IMPLICATIONS

#### To the Editor:

To those who have given consideration to the matter, there is little doubt that the use of fluorophotography in hospitals is going to be rather widely introduced during the coming year. The chief impetus to the program comes from the earmarking of certain funds for the purchase of fluorophotographic equipment by many of our State departments of health and State or local tuberculosis associations. A certain attractiveness to the idea immediately ensues, particularly on the part of hospital boards and superintendents, when it is learned that all or part of the necessary equipment to make such examinations may be obtained without cost. At times, let it be understood, certain provisions are being stated or at least recommended for its manner of use. Certain other hospitals, well endowed or in adequate funds for the purchase of photofluorographic units, are now in the act of obtaining them independently, upon the direct recommendations of their radiologists.

A letter of inquiry was recently addressed to the secretaries of each of the component State, city, or county radiologic societies listed in RADIOLOGY, stating briefly the trend of events as developed up to this time within the writer's home State of Wisconsin, requesting information regarding the development of the program in that part of the country represented by each secretary-addressee. The response was prompt and generous, some twenty-seven replies from all parts of the country being received in response to forty-nine inquiries.

These responses indicate a wide difference in the phase of development of the program in various parts of the country and also in the amount of

thought given and action taken by the various component societies of organized radiology in the United States.

The manner of procedure also has been found variable, a few hospitals planning to use the equipment primarily for nurses, medical students, interns, and hospital employees, or free clinic cases only, a larger group proposing to make the procedure mandatory for every admission (if not obtainable at time of admission, then at some time prior to discharge, when the patient's condition permits). Other replies indicated that the procedure was to be employed as regularly as it could be conveniently done or whenever requested, but that it would not be a compulsory measure required for every hospital admission. While the last-named arrangement would, of course, permit certain cases to pass in and out of a given institution without having the benefit of a miniature chest roentgenogram, it would not discourage the attending physician from bringing into the hospital an acute abdominal illness, head injury, or serious fracture case, nor would it discourage or duplicate survey work of industrial employees or other groups already being done quite widely in some States in physicians' offices or industrial plants (notably Wisconsin, where a pre-employment and re-examination program, including a routine miniature or full-size chest film, has been quite widely employed in the urban areas for the past eight to ten years).

Where the fee for this service has been considered or set, \$3 or \$2 was the figure usually stated. If we are right in believing the fundamental factors to consider in arriving at these fees are (1) cost of performing the examination, (2) its value to the patient, and (3) its ultimate effect on the entire radiologic fee schedule, this charge would appear to be a reasonable and fair one. In a half dozen or more localities a plan of remuneration of \$15 to \$25 per hour was stated, but this plan would obviously be more applicable where there was no individual fee charged each person examined and where the source of payment was some State tuberculosis association fund or an industrial corporation. In one reply it was indicated that the moneys so earned by the radiologists' cooperative efforts were to be turned over in their entirety to the treasury of the State radiologic body.

It has, of course, been emphasized on all sides that the fee must be kept in relation to other non-routine radiologic service charges in order to attract the largest possible number of examinations. On the other hand, it can fairly be pointed out that, in making such a study a more or less routine procedure with certain exceptions, as stated above, the true overhead cost in the department will increase out of proportion to the relatively modest cost of film used. This would, of course, not be true were it possible to employ "mass production" methods in performing the radiographic procedures (such as was done ideally, for example, on a large battleship

in the Pacific prior to the ending of the war, when approximately 3,000 naval personnel were studied by 35-mm. roll miniature film in a period of forty-eight hours, with no member of the personnel being off duty for longer than thirty minutes). In marked contrast, hospital admissions would come "one at a time" at all hours of the day and night and not be evenly spaced.

As stated at the outset, this program, under the impetus of free equipment, appears destined to rather widespread acceptance and application in the field of medical service in the hospital. It therefore behooves all physicians, particularly those doing hospital radiologic practice, to be aware of all the implications, to guide the program wisely, and be certain that the uses and limitations of the procedure be not misunderstood either by the physician or his patient.

J. EDWIN HABBE, M.D.  
Milwaukee, Wis.  
Jan. 31, 1946

## In Memoriam

OPIE W. SWOPE, M.D.

Opie W. Swope, M.D., of Wichita, Kans., died on Dec. 12, 1945, at the age of 61. He was born in Lindsie, Monroe County, West Virginia, in 1882 and was graduated from Maryland Medical College, Baltimore, in 1905. Shortly after he entered upon the practice of medicine his interests turned to radiology and he is to be classed among the pioneers in that field. He was a great champion of the curative value of x-rays and he had a tremendous following of grateful patients. He made both friends and enemies in a colorful and successful career. For a man to achieve his eminence with the handicaps of diabetes, deafness, tuberculosis, and cataracts is an achievement that may be considered almost superhuman.

Dr. Swope was a diplomate of the American Board of Radiology and a member of the American College of Radiology and the Radiological Society of North America. Radiologists have lost a real friend in their fraternity.

N. W. NASH, M.D.

JOSEPH S. GIAN-FRANCESCHI, M.D.

Dr. Joseph S. Gian-Franceschi of Buffalo, N.Y., died on Oct. 17, 1945, at the age of 61. Dr. Gian-Franceschi was a member of the staffs of the Emergency and Columbus Hospitals, Buffalo, and an associate staff member of the Lafayette Hospital. He was a diplomate of The American Board of Radiology, a member of the Radiological Society of North America and the American College of Radiology, and secretary and past president of the Buffalo Radiological Society.

## Book Reviews

**ROENTGEN DIAGNOSIS OF DISEASES OF THE GASTRO-INTESTINAL TRACT.** By JOHN T. FARRELL, JR., M.D., Clinical Professor of Radiology, Graduate School of Medicine, University of Pennsylvania; Radiologist, Hermann Hessenbruch Memorial Department of Radiology, The Lankenau Hospital; Radiologist, Children's Hospital of the Mary J. Drexel Home; Roentgenologist, White Haven Sanatorium; Consulting Roentgenologist, Frederick Douglass Memorial Hospital; Consulting Roentgenologist, Mercy Hospital. A volume of 271 pages, with 190 illustrations. Published by Charles C Thomas, Springfield, Ill., 1946. Price \$5.50.

As Clinical Professor of Radiology in the Graduate School of Medicine, University of Pennsylvania, Dr. John T. Farrell, Jr., furnished his classes with mimeographed outlines of his lectures on the roentgen diagnosis of gastro-intestinal diseases. These outlines, repeatedly revised, form the nucleus of a volume which students everywhere will find a valuable aid in approaching this important subject or rapidly reviewing it. The book is a guide not only to roentgen procedure, but gives succinctly the fundamental features underlying the various abnormalities and diseases of the alimentary system.

Much of the text is in outline form, which is in accord with the author's statement that he has intended the work as a manual rather than a reference book. He has used as a basis the topographic and etiologic classification of the "Standard Nomenclature of Disease," and under each of the pertinent headings has outlined and discussed briefly the characteristic changes in contour, motility, and position which furnish a clue to diagnosis.

The book is well made and amply illustrated with reproductions of photographs and roentgenograms. The liberal use of boldface and italic type is appropriate in a manual of this type.

**EXPERIMENTS WITH MAMMALIAN SARCOMA EXTRACTS IN REGARD TO CELL-FREE TRANSMISSION AND INDUCED TUMOR IMMUNITY: FURTHER STUDIES OF THE KREBS, RASK-NIELSEN, WAGNER SARCOMA.** By CARL KREBS, OSKAR THORDARSON, AND JOHANNES HARBO. Supplementum XLIV to *Acta Radiologica*. A volume of 96 pages. The Hafnia Printing House, Aarhus, Denmark, 1942.

In 1930 Krebs, Rask-Nielsen, and Wagner published an account of a transmissible lymphosarcoma in white mice (Supplementum X to *Acta Radiologica*. Reviewed in *RADIOLOGY* 16: 534, 1931). Krebs, Thordarson, and Harbo have continued the investigation of this tumor in an attempt to determine (1) whether it is caused by a virus and, under

suitable conditions, is transmissible by cell-free material, and (2) whether resistance to transmission can be enhanced by injection of tumor extracts.

The attempts to prove the existence of a virus or cell-free agent included experiments with absolutely cell-free materials and with tumor material that had been subject either to autolysis, irradiation, or dehydration and mincing. From their observations the authors obtained no evidence in support of a virus origin for the tumor. It is true that transmission was successful in a few instances following irradiation of the injected tumor material with large roentgen doses, but this is attributed to surviving cells.

The experiments on the effect of injected cell-free tumor material on resistance to inoculation are still in progress, and the authors state that on this point the present communication is to be regarded only as a preliminary report. "From the results of the experiments made, it must be considered as overwhelmingly probable that the resistance of the mice against transmission of the tumor can be measurably increased by treatment with extractive substances from the tumor."

A bibliography is appended, and, what is rather unusual in the supplements to *Acta Radiologica*, an index.

**RADIOTHERAPY IN ACTINOMYCOSIS.** By EIVIND STOKKELAND. Supplementum L to *Acta Radiologica*. A volume of 53 pages, with 4 illustrations. Fabritius & Sonners, Oslo, 1943.

This monograph on the radiotherapy of actinomycosis comes from the Norwegian Radium Hospital. In an introductory chapter the author reviews briefly the etiology and pathology of actinomycosis, cites the results of irradiation in several clinics, and discusses in a general way the technic and dosage employed. His own material of 33 cases he classifies on the basis of regional distribution, as follows:

Cervico-facial types.....	25 cases
Abdominal types.....	8 cases
Thoracic types.....	1 case
Other types.....	1 case (extremity)

Several methods of treatment are cited. Some are discussed at considerable length. In the present series both radium and roentgen rays were used. Fractional roentgen therapy, now considered the treatment of choice, was most frequently employed, with a daily dose of 50 to 200 r, though in some instances daily doses of 300 r were given. The total dose per field was 1,750 to 3,000 r, a single field being the general rule. In 4 cases a single series sufficed, but in other cases the series was repeated at intervals of four weeks to four months.

All of the patients with disease of the cervico-facial type were cured. Of the 8 patients with abdominal disease, 4 were cured, 2 were improved, and

2 were still under treatment at the time of the report. The patient with thoracic disease died. In the remaining case, in which an extremity was involved, roentgen therapy was supplemented by amputation, with lasting recovery.

UNTERSUCHUNGEN ÜBER DIE RÖNTGENNAHBESTRAHLUNG. EINE STUDIE ÜBER PHYSIKALISCHE LEISTUNGEN UND KLINISCHE ERGEBNISSE MIT DEM PHILIPS METALIX - NABSTRAHL - THERAPIE-APPARAT. By SVEN HULTBERG. Supplementum LIV to Acta Radiologica. A volume of 219 pages, with 63 illustrations. Published by Hakan Ohlssons Boktryckeri, Lund, 1943.

This monograph on contact therapy, from the Radiologic Clinic in Lund, opens with an historical survey of the method and a description of the Philips-Metalix apparatus used in that institution since 1940. The results of physical measurement of the rays are also presented. The subsequent chapters deal with skin cancer, cancer of the lip, precancerous hyperkeratosis and leukoplakia, warts, hemangiomas, keloids, and a number of isolated examples of cancer of the oral cavity, penis, etc. High percentages of cures are reported after follow-up periods of a few months to three years.

A series of tables presents concisely the case histories, and 63 figures are included, chiefly before-and-after views of cases treated.

A smaller group of cases, presumably included in the present series, was reported by the author in *Acta Radiologica* 24: 328, 1943 (Abst. in *RADIOLOGY* 45: 642, 1945).

STUDIEN ÜBER DIE KUMULATIVE WIRKUNG DER RÖNTGENSTRAHLEN BEI FRAKTIONIERUNG. ERFABUNGEN AUS DEM RADIUMHEMMET AN 280 HAUT- UND LIPPENKARZINOMEN. By MAGNUS STRANDQVIST. Supplementum LV to Acta Radiologica. A volume of 300 pages, with 18 plates containing 111 illustrations. Published by P. A. Norstedt & Söner, Stockholm, 1944.

This monograph from the Radiumhemmet, Stockholm, is written in German, with an English summary of several pages. It is based on a study of 183 cases of basal-cell and 74 cases of squamous-cell carcinoma of the skin and 23 carcinomas of the lip. The clinical picture, technic of treatment, dosage, and results in each case are presented in a table of 46 pages. From his observations in this series the author seeks to analyze the correlation between the

total roentgen dose and total treatment period in cases with similar biologic effects following daily divided doses. He presents his own fractionation curve and compares his fractionation factors with values obtained by other workers, notably Reisner of Germany and Quimby in America. It is repeatedly stressed that the main purpose of the study is not to establish definite figures, but to present working methods with the help of which future investigations may yield a better understanding of fractionation curves for various objects.

THE RADIOSENSITIVITY OF BONE MARROW. By TORFINN DENSTAD. Supplementum LII to Acta Radiologica. A volume of 176 pages, with 9 diagrams, 11 photomicrographs, and 8 tables. Printed in Norway by Centraltrykkeriet, Oslo, 1943.

The reaction of the bone marrow to radiation is of significance, as the author of this monograph states, from several standpoints, notably the treatment of such diseases as myelogenous leukemia and polycythemia, a better understanding of the leukopenia frequently observed following even small doses of radium and x-rays, and the question of lasting injury to the marrow and its bearing on the diagnostic value of subsequent sternal puncture.

The present study is based on a series of 125 patients receiving radiotherapy, chiefly for malignant neoplasms and lymphogranulomatosis in a number of different institutions. It embraces both the indirect effects on the unirradiated marrow and the direct effects. As to the indirect effects, the author concludes that irradiation, whether with x-rays or radium, in cancericidal doses, produces no morphological changes in the non-irradiated marrow in patients without granulocytopenia. Where the radiation causes granulocytopenia, however, a mild degree of maturation inhibition of myelopoiesis was observed, while there appeared to be some stimulation of erythropoiesis. To direct irradiation the cells of the bone marrow proved highly radiosensitive, the erythroblasts slightly more than the myeloid cells. Within each series of cells, the youngest forms were the first to disappear, while the older ones disappeared with increasing doses. Regeneration was good, the erythroblasts regenerating first and the myeloid cells somewhat later.

The author includes an account of earlier investigations on this problem, with a bibliography of several pages.

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## RADIOLOGICAL SOCIETIES OF NORTH AMERICA

*Editor's Note.*—Will secretaries of societies please cooperate by sending information to Howard P. Doub, M.D., Editor, Henry Ford Hospital, Detroit 2, Mich.

### UNITED STATES

*Radiological Society of North America.*—Secretary, D. S. Childs, M.D., 607 Medical Arts Bldg., Syracuse 2, N.Y.

*American Roentgen Ray Society.*—Secretary, Harold Dabney Kerr, M.D., Iowa City, Iowa.

*American College of Radiology.*—Secretary, Mac F. Cahal, 20 N. Wacker Dr., Chicago 6, Ill.

*Section on Radiology, American Medical Association.*—Secretary, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

### ARKANSAS

*Arkansas Radiological Society.*—Secretary, J. S. Wilson, M.D., Monticello. Meets every three months and annually at meeting of State Medical Society.

### CALIFORNIA

*California Medical Association, Section on Radiology.*—Secretary, Gordon King, M.D., Children's Hospital, San Francisco.

*Los Angeles County Medical Association, Radiological Section.*—Secretary, Roy W. Johnson, M.D., 1407 South Hope St., Los Angeles. Meets second Wednesday of each month at County Society Building.

*Pacific Roentgen Society.*—Secretary, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with California Medical Association.

*San Diego Roentgen Society.*—Secretary, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego, Calif. Meets first Wednesday of each month.

*San Francisco Radiological Society.*—Secretary, Joseph Levitin, M.D., 516 Sutter St., San Francisco 2. Meets monthly on the third Thursday at 7:45 P.M., first six months of the year in Lane Hall, Stanford University Hospital, and second six months in Toland Hall, University of California Hospital.

### COLORADO

*Denver Radiological Club.*—Secretary, A. Page Jackson, Jr., M.D., 304 Republic Bldg., Denver 2. Meetings third Friday of each month, Denver Athletic Club.

### CONNECTICUT

*Connecticut State Medical Society, Section on Radiology.*—Secretary, Max Climman, M.D., 242 Trumbull St., Hartford 3. Meetings bimonthly, second Thursday.

### FLORIDA

*Florida Radiological Society.*—Secretary-Treasurer, J. F. Pitman, M.D., Blanche Hotel Annex, Lake City.

### GEORGIA

*Georgia Radiological Society.*—Secretary-Treasurer, James J. Clark, M.D., 478 Peachtree St., N. E., Atlanta 3. Meets in November and at the annual meeting of State Medical Association.

### ILLINOIS

*Chicago Roentgen Society.*—Secretary, Fay H. Squire, M.D., 1753 W. Congress St., Chicago 12. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April.

*Illinois Radiological Society.*—Secretary-Treasurer, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly by announcement.

*Illinois State Medical Society, Section on Radiology.*—Secretary, Frank S. Hussey, M.D., 250 East Superior St., Chicago 11.

### INDIANA

*The Indiana Roentgen Society.*—Secretary-Treasurer, Harold C. Ochsner, M.D., Methodist Hospital, Indianapolis 7. Annual meeting in May.

### IOWA

*The Iowa X-ray Club.*—Secretary, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of Iowa State Medical Society.

### KENTUCKY

*Kentucky Radiological Society.*—Secretary-Treasurer, Sydney E. Johnson, M.D., 101 W. Chestnut St., Louisville.

### LOUISIANA

*Louisiana Radiological Society.*—Secretary-Treasurer, Johnson R. Anderson, M.D., North Louisiana Sanitarium, Shreveport. Meets annually at same time as State Medical Society.

*Orleans Parish Radiological Society.*—Secretary, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

*Shreveport Radiological Club.*—Secretary, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday, 7:30 P.M.

### MARYLAND

*Baltimore City Medical Society, Radiological Section.*—Secretary, Charles N. Davidson, M.D., 101 West Read St., Baltimore 1.

### MICHIGAN

*Detroit X-ray and Radium Society.*—Secretary-Treasurer, E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms.

### MINNESOTA

*Minnesota Radiological Society.*—Secretary, A. T. Stenstrom, M.D., Minneapolis General Hospital, Minneapolis 26. Meetings quarterly.

### MISSOURI

*Radiological Society of Greater Kansas City.*—Secretary, John W. Walker, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Friday of each month.

*St. Louis Society of Radiologists.*—Secretary, Edwin C. Ernst, M.D., 100 Beaumont Medical Bldg. Meets on fourth Wednesday of each month, October to May.

### NEBRASKA

*Nebraska Radiological Society.*—Secretary-Treasurer, Donald H. Breit, M.D., University of Nebraska Hospital, Omaha 5. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

### NEW ENGLAND

*New England Roentgen Ray Society.*—Secretary-Treasurer, George Levene, M.D., Massachusetts Memorial



Hospitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

#### NEW HAMPSHIRE

*New Hampshire Roentgen Society.*—Secretary-Treasurer, Richard C. Batt, M.D., St. Louis Hospital, Berlin.

#### NEW JERSEY

*Radiological Society of New Jersey.*—Secretary, H. R. Brindle, M.D., 501 Grand Ave., Asbury Park. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called.

#### NEW YORK

*Associated Radiologists of New York, Inc.*—Secretary, William J. Francis, M.D., East Rockaway, L. I.

*Brooklyn Roentgen Ray Society.*—Secretary-Treasurer, Leo A. Harrington, M.D., 880 Ocean Ave., Brooklyn 26. Meets fourth Tuesday of every month, October to April.

*Buffalo Radiological Society.*—Secretary-Treasurer, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month, October to May, inclusive.

*Central New York Roentgen Society.*—Secretary-Treasurer, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse 10. Meetings in January, May, and October.

*Long Island Radiological Society.*—Secretary, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

*New York Roentgen Society.*—Secretary, Wm. Snow, M.D., 941 Park Ave., New York 28.

*Rochester Roentgen-Ray Society.*—Secretary, Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

#### NORTH CAROLINA

*Radiological Society of North Carolina.*—Secretary-Treasurer, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meets in May and October.

#### NORTH DAKOTA

*North Dakota Radiological Society.*—Secretary, Charles Heilman, M.D., 1338 Second St., N., Fargo.

#### OHIO

*Ohio Radiological Society.*—Secretary, Henry Snow, M.D., 1061 Reibold Bldg., Dayton 2. Next meeting at annual meeting of the Ohio State Medical Association.

*Cleveland Radiological Society.*—Secretary-Treasurer, Carroll C. Dundon, M.D., 11311 Shaker Blvd., Cleveland 4. Meetings at 6:30 P.M. on fourth Monday of each month from October to April, inclusive.

*Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).*—Secretary-Treasurer, Samuel Brown, M.D., 707 Race St., Cincinnati 2. Meetings held third Tuesday of each month.

#### PENNSYLVANIA

*Pennsylvania Radiological Society.*—Secretary-Treasurer, L. E. Wurster, M.D., 416 Pine St., Williamsport 8. The Society meets annually.

*Philadelphia Roentgen Ray Society.*—Secretary, Calvin L. Stewart, M.D., Jefferson Hospital, Philadelphia 7. Meets first Thursday of each month at 8:00 P.M., from October to May in Thomson Hall, College of Physicians, 21 S. 22d St.

*Pittsburgh Roentgen Society.*—Secretary-Treasurer, Lester M. J. Freedman, M.D., 4800 Friendship Ave., Pittsburgh 24. Meets second Wednesday of each month at 6:30 P.M., October to May, inclusive, at The Ruskin, 120 Ruskin Ave.

#### ROCKY MOUNTAIN STATES

*Rocky Mountain Radiological Society* (North Dakota, South Dakota, Nebraska, Kansas, Texas, Wyoming, Montana, Colorado, Idaho, Utah, New Mexico).—Secretary, A. M. Popma, M.D., 220 North First St., Boise, Idaho.

#### SOUTH CAROLINA

*South Carolina X-ray Society.*—Secretary-Treasurer, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

#### TENNESSEE

*Memphis Roentgen Club.*—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

*Tennessee Radiological Society.*—Secretary-Treasurer, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

#### TEXAS

*Dallas-Fort Worth Roentgen Study Club.*—Secretary, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month, in Dallas in the odd months and in Fort Worth in the even months.

*Texas Radiological Society.*—Secretary-Treasurer, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth 4.

#### VIRGINIA

*Virginia Radiological Society.*—Secretary, E. Latan Flanagan, M.D., 215 Medical Arts Bldg., Richmond 19.

#### WASHINGTON

*Washington State Radiological Society.*—Secretary-Treasurer, Thomas Carlile, M.D., 1115 Terry Ave., Seattle. Meetings fourth Monday of each month, October through May, at College Club, Seattle.

#### WISCONSIN

*Milwaukee Roentgen Ray Society.*—Secretary-Treasurer, C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee 3. Meets monthly on second Monday at the University Club.

*Radiological Section of the Wisconsin State Medical Society.*—Secretary, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society in September.

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## ROENTGEN DIAGNOSIS

## THE HEAD AND NECK

**Radiology of War Injuries. Part IV. War Wounds of the Head and Neck.** D. B. McGrigor and Eric Samuel. *Brit. J. Radiol.* 18: 221-228, July 1945.

Injuries of the head and neck constitute about 11 per cent of war wounds: 50 per cent involve the vault of the skull and 50 per cent the face and neck.

Radiological reports of injuries of the cranium should describe the site of the fracture, its size, its type, and any involvement of vascular channels. There is no simple comprehensive technic for investigation of injuries of the head and neck. The type of examination is determined by the injury. In the majority of cases an anteroposterior view and a lateral view in the brow-up position, including the mandible, are sufficient. For penetrating wounds of the orbit and frontal sinuses a postero-anterior projection is necessary. Injuries of the facial bones require stereoscopic occipitontal views, lateral views of the facial bones, occlusal and dental views of the nose, and lateral views of both mandibles. Tomography is often of great value.

Injuries caused by missiles are of varying degrees of severity. Only the outer table may be injured, or there may be through-and-through penetration with varying degrees of inward displacement of bone fragments. Elevated fractures may occur at the wound of exit.

The demonstration of intracranial air is of the utmost importance. When air appears over the surface of the brain (in the sulci), special attention should be given to the air sinuses for evidence of fracture.

In wounds of the neck radiology is used chiefly in the location of foreign bodies. Wounds of the larynx and trachea may give rise to extensive subcutaneous emphysema.

Fractures involving the facial bones frequently involve the nasal accessory sinuses.

SYDNEY J. HAWLEY, M.D.

**On the Roentgen Diagnosis of Cholesteatoma in the Temporal Bone.** Solve Welin. *Acta radiol.* 25: 227-239, June 30, 1944. (In English.)

The roentgen diagnosis of cholesteatoma is based on its bone-destroying effects. The sharp definition, angularity, and polygonal shape of cholesteatoma cavities, their occurrence in temporal bones with reduced pneumatization, and a linear calcareous zone between them and the surrounding bone tissue have been held to be characteristic features.

The author's material consisted of 109 cases, of which 5 were bilateral. He has divided them according to localization into three groups, cholesteatoma (1) in the aditus ad antrum, (2) in the antrum, and (3) in the attic.

(1) The most common and most important roentgenologic indication of cholesteatoma, according to the author, is pathological enlargement of the aditus ad antrum. The aditus was enlarged in 68 of his cases. The change may be very slight, or the inner portion of the posterior wall of the auditory canal may be almost completely destroyed.

(2) Roentgenologically a distinction is made between cholesteatoma in non-pneumatized temporal bones and in pneumatized temporal bones. In the

first named, a diagnosis cannot as a rule be made by roentgen examination except in the presence of rather extensive destruction unless there is also a pathological enlargement of the aditus. Nor is the diagnosis easy in pneumatized temporal bone. Even large areas of destruction may be difficult to differentiate from an abscess cavity unless the aditus is enlarged.

(3) The author's material included 28 cases of cholesteatoma in the attic, of which 15 produced changes visible in the roentgenogram. The roentgenologic changes differ with the localization of the area of destruction in the epitympanic recess. With destruction in the lateral wall, there is a well defined spike-like or rounded defect in the lower margin of the attic. In cases of cholesteatoma developing posteriorly toward the aditus, the latter may become enlarged. Finally, cholesteatomata may develop upward toward the roof of the middle fossa of the skull and produce destruction there, manifested in the axial view by a distinctly circumscribed thinning in the region of the tympanum.

JOSEPH H. WEISS, M.D.

**Cinematography in Cerebral Angiography.** Olov Fr. Holm. *Acta radiol.* 25: 163-173, June 30, 1944. (In English.)

A brief review of the literature on the development of roentgen cinematography is given, followed by a description of the apparatus and method used in cerebral angiography in the Serafimer Hospital (Stockholm). For these the original paper must be consulted.

Thorotrast and perabrodil are the contrast media used. A schematic plexiglass model was constructed of the cerebral vascular system to study the behavior of the contrast media in a vascular system. This seemed to approximate the behavior in man. The total time for passage from the internal carotid artery to the jugular vein is 3.25 seconds. With cerebral angiography as ordinarily practised, as many as six roentgen exposures can be made, but not even this number is sufficient to demonstrate the entire course of the medium. This can only be done cinematographically.

It is in cases of arteriovenous aneurysm and malignant glioma that the cinematographic method is of particular value. In the presence of arteriovenous aneurysm the passage of the medium is so rapid that there is a danger that in ordinary angiography the first exposure may be made too late. With cinematography the medium can be seen directly as it enters the afferent vessel and a reliable record is obtained of the whole phase, which is of great importance in planning the operative procedure. In malignant glioma, the examiner can follow the course of the contrast medium through the pathologic vessels and can thus form an opinion of their extent.

Less contrast material is required for cinematography than for ordinary roentgenography, and this is an added advantage, especially when thorotrast is used.

On the basis of his experience, the author reaches the following conclusion: "Cinematography of cerebral angiography theoretically is superior to ordinary roentgenography. As a rule it gives a definite diagnosis, and in many cases it has contributed to or verified a diagnosis considered uncertain on the basis of ordinary photography. With the technical resources now at our disposition, however, the time is not yet



ripe to replace the older method with the newer one; instead the two should be used to complement each other."

JOSEPH H. WEISS, M.D.

### THE CHEST

**Plasma Cell Tumors of the Upper Part of the Respiratory Tract.** Frederick A. Figi, Albert C. Broders, and Fred Z. Havens. *Ann. Otol., Rhin., & Laryng.* 54: 283-297, June 1945.

This report is based on a study of 11 cases of solitary plasma-cell myelomas, or plasmocytomas, of the upper part of the respiratory tract observed at the Mayo Clinic in a period of fourteen years. Seven of the patients were males and 4 females; the age range was thirty-seven to seventy-one years.

Plasmocytomas may arise in any portion of the upper respiratory tract. In the present series the site was as follows: the maxillary sinus in 6 cases; the oropharynx in 2 cases; the nasopharynx in 2 cases; and the larynx in the remaining case. In most instances there is a history of symptoms for less than six months, but they may have been present for a year or more. The most common complaints are swelling of the cheek, nasal obstruction, and frontal headache. Where the condition is primary in the mouth or pharynx, the patients are aware of the presence of a tumor, and some of them experience dysphagia.

The general appearance of the patients in this series varied with the stage of the disease. Some were in good general health and showed no evidence of systemic effects of the neoplasm. Others had the cachexia, anemia, weakness, and disability usually associated with an advanced malignant tumor.

Examination generally has revealed a tumor that appeared highly malignant. In all of the cases with primary involvement of the maxillary sinus, the findings were indicative of malignancy. Bulging of the palate, alveolus, cheek, and lateral wall of the nose, complete density of the maxillary sinus on transillumination, and elevation and, at times, proptosis of the eye were present. Clinical evidence of involvement of regional lymph nodes was noted only once in this series. In that case, the tumor, which originated in the right tonsil, had an ulcerated polypoid appearance. It measured 3 × 2.5 cm., while the metastatic growth in the right cervical region was 4 cm. in diameter.

Roentgenographic studies of the bony structures of the involved region and of the thorax were made in all the authors' cases. Where the neoplasm involved the accessory sinuses, roentgenographic examination frequently showed much more extensive involvement than was suspected clinically. In several instances, a tumor that appeared clinically to involve only the maxillary sinus and nasal fossa was found by roentgenographic examination to be present in the ethmoid cells and frontal sinus as well. In this group, too, malignant destruction of the floor and walls of the maxillary sinus, ethmoid cells, orbit, nose, and zygoma at times was evident. In one case where a non-ulcerated tumor protruded from the vault of the nasopharynx, roentgenograms showed extensive destruction of the sella turcica and cloudiness of the sphenoid sinus, which revealed either of these regions as the site of origin of the neoplasm. Roentgenograms of the thorax were normal in all of the patients at the original examination at the Clinic.

In only one of the 11 cases was metastatic involvement of bone demonstrable roentgenographically at the time of the primary examination. This patient had a huge, rapidly recurring tumor of the upper jaw, maxillary sinus and ethmoid cells, with what appeared to be multiple areas of metastatic destruction throughout the skull as well. There were no symptoms referable to the secondary tumors.

Unquestionably, this type of tumor is rare. The 2 plasma-cell tumors encountered in the pharynx occurred among approximately 360 malignant neoplasms in that region; the 2 in the nasopharynx were found among more than 300 malignant growths in that situation. Approximately 625 cases of malignant growths of the nose and accessory sinuses were observed during the fourteen years covered by this report. Yet among these, only 6 cases of plasma-cell myeloma were discovered. The single laryngeal tumor was one of more than 1,600 malignant neoplasms of the larynx.

The authors cannot agree that plasmocytomas may be of inflammatory origin. Some of their series were fulminating malignant tumors and others only mildly malignant, but all were true neoplasms. Microscopically, the neoplastic plasma cells are usually diffusely massed like the cells of a lymphosarcoma. A single-file effect comparable to the cells of certain carcinomas of the breast and the stomach may be presented. That any of these tumors were granulomatous or inflammatory was not remotely suggested.

STEPHEN N. TAGER, M.D.

**Bronchography in Pulmonary Tuberculosis: Artificial Pneumothorax.** B. A. Dormer, J. Friedlander, and F. J. Wiles. *Am. Rev. Tuberc.* 52: 21-35, July 1945.

The effect on the lungs of artificial pneumothorax has been studied by means of bronchography and 11 cases are described and illustrated. The authors have emphasized in previous articles the importance of bronchial and bronchiolar obstruction in pulmonary tuberculosis. Bronchographic studies indicate that the reason artificial pneumothorax can be a successful method of treatment is because it tends to eliminate such bronchial obstruction. Artificial pneumothorax causes peripheral collapse. The general retraction and shrinking of alveoli and connective tissue prevent further infection and tend to squeeze liquefied tuberculous material out of the blocked bronchioles, leaving them patent. This allows healing by fibrosis. If bronchial block persists in spite of pneumothorax, the procedure will have no therapeutic value. The development of lobar atelectasis following the induction of pneumothorax is an indication for quickly abandoning the procedure if normal relationships cannot be established otherwise.

L. W. PAUL, M.D.

**Incidence of Tuberculosis in Japanese-Americans: A Study of a Homogeneous Racial Group.** H. E. Bass and G. D. Carlyle Thompson. *Am. Rev. Tuberc.* 52: 46-50, July 1945.

A study of the incidence of tuberculosis in a homogeneous racial group of Japanese-Americans is presented. Reactors to the tuberculin test were studied by fluoroscopy, with subsequent roentgenograms when needed. Of a total of 2,771 persons receiving tuberculin tests, 1,233 (45 per cent) were positive. The incidence of tuberculosis was 3.69 per cent—45 cases, of



which 5 were classified as active, 32 as arrested, and 8 as apparently cured. The findings indicate that the incidence of pulmonary tuberculosis in this group is no higher than that of similar groups of native Americans from the same geographic area. L. W. PAUL, M.D.

**Tuberculosis Survey of Food Handlers on the Island of Oahu.** Joseph E. Perkane and Richard K. C. Lee. *Am. Rev. Tuberc.* 52: 51-57, July 1945.

Beginning in August 1943, the health department regulations in the Territory of Hawaii were amended to require an x-ray examination of the chest of all food handlers. The present report details the findings in 10,000 food handlers who were studied by means of 4 X 5-inch fluorograms supplemented by standard roentgenograms when indicated. Altogether 537 persons had suspicious or characteristic lesions of tuberculosis, necessitating further x-ray and epidemiological study. Of these, 314 (3.14 per cent) were considered to have characteristic lesions, with 80 persons (0.8 per cent) having active tuberculous disease. The majority of cases discovered were in the minimal and moderately advanced stages.

L. W. PAUL, M.D.

**Incidence of Extrapulmonary Tuberculous Infection in Fatal Pulmonary Tuberculosis.** R. A. Willis and D. B. Rosenthal. *M. J. Australia* 2: 39-42, July 14, 1945.

The authors tabulate the visceral lesions demonstrated at autopsy in three series of patients dying of pulmonary tuberculosis. The extrapulmonary involvement in one series of 121 autopsies was as follows:

Intestine.....	52.0%
Ulcers, small intestine.....	52.0%
Perforated ulcers, small intestine.....	7.0%
Hyperplastic ileocecal tuberculosis.....	12.0%
Ulcers, large intestine.....	5.0%
Vermiform appendix affected.....	10.0%
Peritoneum (independent of intestine).....	2.5%
Liver.....	2.5%
Spleen.....	4.0%
Kidneys.....	9.0%
Adrenals.....	5.0%
Larynx and pharynx.....	22.0%
Meninges.....	2.5%
Pericardium.....	7.0%

The total incidence of extrapulmonary tuberculosis in this series was 68 per cent, which is almost identical with that in the other series reported, from different institutions. Microscopic studies of apparently normal viscera in a group of 50 autopsied cases indicate, however, that figures based solely on gross observations are too low. Actually, the incidence of extrapulmonary lesions in fatal pulmonary tuberculosis is approximately 90 per cent. Tuberculosis, therefore, should be regarded as a general disease with the most important localization in the lungs rather than as a purely pulmonary infection, and clinical search for extrapulmonary sites of involvement should be systematically carried out.

PERCY J. DELANO, M.D.

**Attitude of Industry Toward X-Ray Examinations of the Chest.** C. D. Selby. *J. A. M. A.* 128: 630-632, June 30, 1945.

The author concludes that industry has no well defined attitude toward x-ray examinations of the chest.

Its position is influenced by the opinions of physicians who are accustomed to advise with management on medical affairs, and is, therefore, in reality the attitude of the medical profession.

In making x-ray chest service available to employees, industry wishes the relationships which necessarily result from case finding to be professionally ethical, suitable to the best interests of the employees, and in conformance with local public health regulations and practices.

In industry the diagnosis of pulmonary tuberculosis and other lesions of the thoracic organs is usually based on the interpretation of films and is necessarily tentative. No such diagnosis is complete until substantiated by clinical observation, which is the function of the patient's own physician. Nevertheless, the interpretation of the films should be supported by x-ray knowledge and experience.

In some plants the radiologist is responsible for the x-ray technic and the reading of all films, in others for the reading of films only, or for reading of films which are not obviously negative. The first plan is the most desirable, but not always the most practical; the other arrangements have proved effectual and workable.

**Relapsing, Diffuse, Pulmonary Bleedings or Hemosiderosis Pulmonum—a New Clinical Diagnosis.** Jan Waldenström. *Acta radiol.* 25: 149-162, April 1944. (In English.)

In 1921 Ceelen described the anatomical changes found in two cases showing extensive hemosiderosis of the lungs and referred to Virchow as the only author who had described similar changes. Two new cases are recorded here.

The exact pathogenesis of the condition is not yet clear. There is primarily a disturbance in pulmonary circulation, along with a "chlorotic" type of iron deficiency anemia, with bleeding per diapedesis. Extensive fibrosis occurs throughout the lung with accumulation of iron pigment primarily in the cellular elements of the alveoli. Hemosiderin is also present in the regional lymph nodes but not elsewhere in the body.

The patients are children or adolescents and the symptoms are dyspnea and coughing, sometimes with blood-tinged sputum or small coagula. Colicky pain in the abdomen is often present. Hemosiderin and so-called "heart failure" cells are not a constant finding in the sputa. There is an anemia of hypochromic type, markedly sensitive to iron treatment but showing a characteristic tendency to relapse after treatment is discontinued. Blood studies reveal some degree of hemolysis along with hyperregeneration (reticulocytosis).

The final diagnosis is made from the roentgen picture. There occurs in both lungs, rather symmetrically disposed, a widespread infiltration of reticular design. Diffuse mottling with very small opacities may be seen. The vessels are not so clearly visible as would be the case in pulmonary stasis. The apical fields remain relatively clear, the mid-lung fields showing greatest involvement, with smoky infiltration obscuring the cardiac borders. There are sometimes seen more extensive infiltrations obviously caused by atelectasis. The roentgen findings may disappear in part or entirely with the temporary clinical remissions.

The development of the pulmonary picture with alternating improvement and relapse is more characteristic than the picture at any definite stage. Only

a correlation with the clinical course and hematologic analysis will make the correct interpretation of the roentgen picture possible.

Several excellent reproductions of the typical roentgen findings are presented. VICTOR KREMENS, M.D.

**Clinical Physiological Observations on Welders with Pulmonary Siderosis and Foundry Men with Nodular Uncomplicated Silicosis.** Norbert Enzer, Ernst Simonson, and A. M. Evans. *J. Indust. Hyg. & Toxicol.* 27: 147-158, June 1945.

An investigation was undertaken to determine what degree, if any, of impairment of pulmonary function is associated with siderosis and silicosis and to what extent this affects working capacity. The studies were carried out in groups of normal subjects (varying from 8 to 100 for different functions), 15 patients with siderosis (deposition of iron in the lungs without fibrosis, but with roentgen findings similar to uncomplicated nodular silicosis), and 8 patients with silicosis (nodular and uncomplicated). No statistically significant difference between the normal group and the siderosis group was found in any function, while the silicosis group showed significant depression of vital capacity, maximum pulmonary ventilation, relative pulmonary reserve, and endurance in dynamic and static work. A far greater percentage of patients with silicosis than with siderosis showed an individually significant depression of functions compared to the normal limits. An arbitrary scoring system was employed, composed of the most significant tests, and coefficients were applied for appraisal of the complex working capacity. The total score expressed group differences and individual differences more significantly than any single functional test.

**Transient Focal Pulmonary Edema.** Carleton B. Peirce, Everett F. Crutchlow, Arthur T. Henderson, and Joseph W. McKay. *Am. Rev. Tuberc.* 52: 1-14, July 1945.

Eight cases of Löfller's syndrome are described and the literature on the subject is reviewed. By the uninitiated the roentgenologic manifestations may be confused with those of tuberculosis. The authors' cases, however, showed sufficient characteristics for their differentiation. The amorphous character of the shadows, the appearance of rapid migration from one part of the lung to another, and the transient nature of the densities were notable features. The distribution is not that commonly manifest in tuberculosis. In general, the texture of the individual radiographic shadow was that of a haze or cloud.

A potential allergic factor is strongly suggested in the literature and was true also in the authors' cases. It is their belief that these lesions represent focal areas of transient pulmonary edema, probably associated with an allergic state, rather than local areas of inflammation. L. W. PAUL, M.D.

**Obstructive Pulmonary Emphysema Associated with Pneumonia in Childhood.** Jerome S. Leopold and Emil A. Kratzman. *Am. J. Dis. Child.* 69: 287-290, May 1945.

Two cases of obstructive pulmonary emphysema associated with pneumonia are presented. The children, aged 6 weeks and 7 months, were both admitted to the hospital with findings typical of pneumonia. Administration of sulfadiazine, 1 1/2 grains per pound

of body weight in twenty-four hours, oxygen, and small transfusions of citrated whole blood resulted in complete recovery. Repeated chest roentgenograms showed the presence and ultimate resolution of obstructive emphysema in the lung fields involved by the pneumonic process.

Radiologically the picture is typical. The emphysematous area consists of an abnormal region of decreased density surrounded by a thin, dense, smooth margin. The area is usually ovoid in shape and occasionally loculated; it may be small or may occupy an entire lobe. Fluid may be present. A characteristic feature is the variation in size of these areas observed in repeated examinations. Diagnosis is based on the typical roentgen findings following an episode of respiratory disease and the absence of abnormal physical and laboratory findings.

LESTER M. J. FREEDMAN, M.D.

**Pyopneumothorax in the First Month of Life with Recovery. Two Case Reports.** G. P. Rosemond and H. T. Caswell. *Am. J. Surg.* 68: 383-387, June 1945.

Pyopneumothorax, believed to be due to a staphylococcal pulmonary infection, with abscess formation and perforation into the pleural cavity, occurred in 2 infants in the first month of life. Immediate closed drainage was a life-saving procedure in each case.

X-ray examination of one infant on admission revealed complete pyopneumothorax on the right with a shift of mediastinal structures to the left almost obliterating the left lung. Studies the day following drainage showed much less fluid and air in the pleura. Films two days later showed a loculated anterior collection with the mediastinal structures in normal position. Following the drainage of this fluid, x-ray examination revealed for the first time a small radiolucent area which appeared to be within the substance of the right lower lobe. On the infant's discharge, twenty-one days following admission, the radiolucent area persisted. It was believed to represent a pulmonary cyst, a persistent pulmonary abscess, or a loculated empyema. Eleven days later the infant was readmitted with a slight cough, a temperature of 101° F. (rectal), and a white blood count of 17,900, with 73 per cent polymorphonuclears. Roentgenograms having revealed persistence of the "cyst," a few drops of fluid and several cubic centimeters of air were aspirated from it. Immediate relief of fever, cough, and leukocytosis followed. A check-up x-ray almost a year later revealed no abnormality.

In the second case, a roentgenogram showed complete collapse of the right lung, with marked shift of the mediastinum to the left and the presence of fluid and air. A rib resection was done immediately and a mushroom catheter was inserted for closed drainage with constant suction. Films taken every week in the hospital showed steady expansion of the lung and clearing of pneumonitis. Check-up studies revealed an entirely normal chest.

**Pulmonary Embolism from Obscure Sources.** Aubrey O. Hampton, Andrew G. Prandoni, and John T. King. *Bull. Johns Hopkins Hosp.* 76: 245-273, June 1945.

Ten cases are reported in which an acute chest condition is thought to have been caused by pulmonary embolism, with or without infarction, or with incom-

plete infarction, from various venous sources. Eight of the patients were males. All were at work, had no cardiac disease, gave no history of disorder of the veins, and at the time of admission showed no obvious sign of venous thrombosis, with the exception of a thrombosing hemorrhoid in one patient. None had had a recent operation. None was admitted with a correct diagnosis; one was thought to have primary atypical pneumonia, one pericarditis, one cancer of the lungs (metastatic), two coronary occlusion, one angina pectoris.

Roentgenograms of the chest are not very helpful at the onset, since infarcts are ill defined or are not seen at all during the first four to twenty-four hours. Repeated daily examinations are therefore necessary. The lesion is always in contact with a pleural surface, either at the interlobar fissures or at the periphery of the lung. Two or three pleural surfaces are commonly involved by a single infarct; for example, at the junction of fissures or at the costophrenic angles. The long diameter of an infarct is always parallel to the largest pleural surface involved. The medial or cardiac margin of an infarct is convex or "hump"-shaped and sharp in outline when projected on edge. Oblique and lateral films of the chest are often necessary to obtain profile views and thus demonstrate the lesions. Pleural effusion may obscure the lesion for a few days or may not be present at all. Incomplete infarcts may disappear within two or three days, whereas complete infarction persists for two to three weeks and heals by linear scarring. Large infarcts may remain for months with very little change.

Serial electrocardiograms and phlebograms usually elucidate the diagnosis. In 2 of the 10 cases reported here, the electrocardiograms were normal. In one instance, the T waves were sufficiently inverted to suggest myocardial infarction.

In spite of its limitations, the phlebogram yields information which is important in the control of thrombosis and embolism. Early detection of intravascular clotting by phlebography permits prompt institution of appropriate treatment, thereby preventing the occurrence or repetition of pulmonary embolism. The technic employed is that described by Bauer (*Arch. Surg.* 43: 462, 1941) as modified by Welch, Faxon, and McGahey (*Surgery* 12: 163, 1942. *Abst. in Radiology* 40: 322, 1943.) In the authors' experience no serious ill effects have followed the procedure. Vomiting and urticaria have occurred in a few instances. In 164 examinations, no serious hypersensitivity to diodrast has been observed. Phlebography of the lower extremities reveals all the major venous pathways from the ankle to the pelvis and indicates whether or not a vein is patent, whether the lumen is normal or recanalized, whether collateral venous circulation exists and, if so, its extent. Absence of filling of a vein or segment of a vein indicates the presence of thrombosis. Incipient thrombosis in the plantar and calf muscles cannot be detected, since it is only after the thrombus has involved one of the major venous channels that its presence is revealed.

Error in interpretation may arise from an apparent filling defect in the popliteal vein due to hyperextension of the knee during the injection. A convex filling defect frequently seen in the upper third of the thigh is produced by the pressure of the femoral artery on the femoral vein. Venous spasm resulting from apprehension, irritation by the contrast substance, or vein puncture may give rise to narrowing, or, in extreme cases, to obliteration of the deep veins, according to some authors.

Heparin and dicumarol anticoagulant therapy has

been used, with rest and elevation of the part affected by thrombosis or phlebitis. No detectable embolism has been discovered after institution of such treatment.

Numerous roentgenograms are reproduced.

**Transient Heart Block in Congenital Heart Disease.** Samuel Waldman. *Am. Heart J.* 30: 92-100, July 1945.

In the presence of congenital heart disease, heart block may be present as a functional part of the congenital defect or may occur as an acquired disturbance, superimposed upon the congenital deformity. The heart block may be complete or incomplete, transient or permanent.

The author gives the case history of an 18-year-old male with congenital "heart trouble," who suffered transient episodes of heart block following undue exertion. These episodes were associated with mild attacks of Stokes-Adams syndrome: periodic attacks of giddiness, faintness, and transient periods of unconsciousness lasting a minute or less. An electrocardiogram made three hours after the onset of the attacks showed varying degrees of heart block, with subsequent return to normal. During the filming of Lead II, the patient fainted for several seconds, and periods of lightheadedness with sensations of faintness recurred.

Fluoroscopic and roentgenographic studies showed an enlarged heart, diminished aortic knob, marked prominence of the pulmonic curve, straightened left cardiac contour, and an accentuated left ventricular curve, indicating a patent ductus arteriosus. There was no evidence of a patent interventricular septum.

Parkinson, Papp, and Evans (*Brit. Heart J.* 3: 171, 1941) collected and reported 56 cases of Stokes-Adams attacks with electrocardiograms taken during the attack and added 8 more cases, but none of these is known to have had a congenital basis. Faessler (*Ann. pædiat.* 153: 327, 1939) collected 8 cases of Stokes-Adams attacks in congenital heart disease.

The physiopathology of Stokes-Adams attacks in congenital heart disease is discussed. Fluctuations in the conductivity of the A-V bundle have to do with (1) pressure and tension variations on the bundle, and (2) circulatory variations causing block.

HENRY K. TAYLOR, M.D.

**Intracardiac Foreign Body. Report of a Case with Recovery.** Robert Shapiro. *Am. Heart J.* 30: 88-91, July 1945.

A 21-year-old male was struck by shrapnel from a Japanese shore battery. At the time of injury he felt only a dull, constricting, non-radiating ache in the right side of his chest, along with some dyspnea. On admission to an army field hospital, eight hours later, he was in shock. Shrapnel wounds were found in the lateral aspect of the right arm, some in the region of the right iliac crest, and one in the right side of the back near the angle of the scapula. A hemopneumothorax was present on the right side with considerable displacement of the mediastinal structures to the left. A small metallic foreign body was observed superimposed on the cardiac silhouette.

The patient responded to therapy and two months later was transferred to a Naval Hospital Facility for further study. Radiographic and fluoroscopic studies revealed a rectangular metallic foreign body, 1.0 × 0.6 cm., embedded in the wall of the right ventricle, in the

region of the conus arteriosus. The 4th rib on the right side posteriorly was fractured. This represented the site of entry of the shrapnel fragment in the heart. No mention is made of removal of the foreign body, but the patient was clinically well at the time of the report, with no cardiac symptoms or signs.

HENRY K. TAYLOR, M.D.

**On the Possibility of Studying the Function of the Heart with the Aid of Roentgen-Cinematography. Roentgen-Cinematography Combined with Electric Recordings of the Resistance of the Cardiac Valves.** Sven Benner, Sven Roland Kjellberg, and Torgny Sjöstrand. *Acta radiol.* 25: 175-182, June 30, 1944. (In English.)

Experimental studies were done on rabbits to determine the possibilities and limitations of roentgen cinematography in the analysis of the functioning of the heart. The electrical resistance of the atrioventricular valves was measured, and a device for recording differences in resistance due to changes in the position of the valves was used.

With the aid of a contrast medium, a cinematographic study was made of the circulation through the heart, while an electrocardiogram and the electrical resistance between the right auricle and ventricle, the right ventricle and the pulmonary artery, and the left ventricle and the aorta were simultaneously recorded. Thirty-two pictures were made per second.

The authors conclude that while roentgen cinematography with a contrast medium gives an idea of the changes in volume connected with the contractions of the auricle and ventricle, it is not possible by this means to determine the moment of the opening and closing of the valves. Recording of electrical resistance between the various chambers of the heart, on the other hand, yielded results in agreement with those obtained earlier with the aid of other physiological methods.

JOSEPH H. WEISS, M.D.

**Intrathoracic Goiters.** Frank H. Lahey. *Surg. Clin. North America* 25: 609-618, June 1945.

An old master, speaking of things that are common knowledge to him, limits the designation intrathoracic goiter to those cases in which the thyroid has descended so far into the thoracic cage and has become so widened in its diameter that it is at no time able to escape upward from its deep position in the mediastinum and pass through the upper thoracic aperture.

The origin of intrathoracic goiters is covered, and the author summarizes his remarks by stating that an adenoma usually arises in the isthmus over the lower pole of the thyroid and eventually descends along the course of least resistance, *i.e.*, downward between the fascial planes into the mediastinum. There are two types: the large spherical type and the long tongue of intrathoracic goiter which frequently runs down beside the trachea deep into the mediastinum.

A roentgen diagnosis of intrathoracic goiter is often made when the condition is not suspected clinically, and roentgen examination of the upper mediastinum should not be neglected in cases of adenoma of the thyroid. The tumor most likely to be mistaken for an intrathoracic goiter is a fibroma of the esophagus. The distinguishing feature of the esophageal tumor is the indentation of the esophagus, demonstrable following a thin barium meal. The other lesions to be differentiated are

neurofibromas, dermoid cysts, and pleural cysts. These do not move with swallowing, nor do they cause tracheal pressure and deviation, since they are not anchored to the paratracheal tissues.

The physical findings of the deviated trachea (and larynx), as well as stridor due to compression of the trachea both in the anteroposterior and lateral diameter, are emphasized.

The operative technic is covered briefly and one interesting procedure is mentioned—ligation of the vessels, causing shrinkage of the mass, followed by sucking out the center of the goiter, thus effecting such marked reduction in its size that it can be extracted.

SYDNEY F. THOMAS M.D.

## THE DIGESTIVE SYSTEM

**Short Esophagus (Thoracic Stomach) and Its Association with Peptic Ulceration and Cancer.** D. W. Smithers. *Brit. J. Radiol.* 18: 199-209, July 1945.

This article is primarily a comprehensive review of the literature on short esophagus, or thoracic stomach, from 1836 to the present.

The theories of the cause of thoracic stomach and its association with peptic ulceration are discussed. The few cases found at autopsy compared with the numbers found on clinical examination are strongly against the two common theories suggested to account for the association: (1) that a congenitally short esophagus, by causing relaxation of the cardia and a reflex flow of gastric juice, leads to ulceration; (2) that the esophagus becomes shortened from scar tissue contraction secondary to the formation of peptic ulceration. The author offers an alternative theory. According to this, there is basically a hiatal orifice deficiency, either congenital or, more commonly, acquired in later life. With the cardiac sphincter in the thorax released from diaphragmatic control, gastric juice tends to flow into the esophagus, predisposing to ulceration. This irritation of the esophageal mucosa causes muscular spasm not only circular but also of the longitudinal muscle, producing a shortening of the esophagus. Sometimes there is aberrant gastric mucosa in the esophagus which secretes gastric juice. Ulceration may then take place without evidence of esophageal shortening or hiatal hernia.

This mechanism may be operative in achalasia of the esophagus, also.

Hiatal hernia and associated cancer have been reported several times, short esophagus and cancer rarely. Two new authenticated cases of the latter association are reported, and a third, doubtful, case, is added.

SYDNEY J. HAWLEY, M.D.

**Singular Case of the Plummer-Vinson Syndrome.** Aage Videbæk. *Acta radiol.* 25: 245-250, June 30, 1944. (In English.)

A 60-year-old woman presented the typical Plummer-Vinson syndrome: dysphagia, hypochromic anemia with low serum iron, fissures at the corners of the mouth, spoon nails, and achylia. Roentgen examination showed a constriction in the esophagus, with dilatation above and retention in the piriform recess and the epiglottic valleculae.

The interesting features of the case are the low situation of the stricture, at the height of the clavicle, the esophagoscopy finding of a membranous diaphragm



across the esophagus at the site of the stricture, and the sudden improvement of the patient's condition as soon as the membrane had been cut through. She was subsequently cured of her dysphagia by bougienage, administration of thiamine and riboflavine, and intensive treatment with divalent iron by mouth and intravenously. The roentgenologic picture of the esophagus became normal, there was less anemia, and the state of the nails improved considerably. The effect on the fissures at the corners of the mouth was moderate, and atrophy of the lingual papillae persisted.

JOSEPH H. WEISS, M.D.

**Gastric Volvulus and Other Abnormal Rotations of the Stomach.** John B. Hamilton. *Am. J. Roentgenol.* 54: 30-40, July 1945.

A rotation of the stomach, reaching or closely approaching 180 degrees, which spontaneously reduces itself, is reducible by manipulation, or can reasonably be assumed to be the result of injury, may be considered to be true gastric volvulus. Other abnormal rotations are those which are not subject to reduction either spontaneously or manually and can be assumed to be variations on a basis of congenital anomalies. Volvulus is classified by the author as (1) organo-axial volvulus (rotation on the coronal axis) and (2) torsion volvulus (about the long axis of the gastro-hepatic omentum).

In the 11 cases described in this paper, relaxed intra-abdominal attachments are believed to have been present. Obesity, trauma, severe weight loss preceding gastric rotation, and anomalous development were varying factors in the etiology. A large, redundant or abnormally situated colon was a feature in several cases of true volvulus. These are often of transient nature. Eventration of the diaphragm on the left side was present in 3 cases. In 2 cases there was herniation of the diaphragm. One patient showed an unusual congenital variation, a right-sided thoracic stomach, congenitally herniated through the foramen of Morgagni. Symptoms varied from pain or discomfort in the epigastrium to nausea and vomiting. There may be remissions between attacks. The characteristic findings in various rotations of the stomach, usually best seen in the upright postero-anterior position, before the fluoroscopic screen, are described and illustrated in connection with the case histories. The condition may be missed unless the patient is examined during an attack.

The organo-axial type of volvulus is the most common. Torsion volvulus must not be confused with the high-lying stomach in the presence of obesity. Cascade stomach has no relation to gastric volvulus. None of the cases reported was of the acute type requiring immediate surgery. CLARENCE E. WEAVER, M.D.

**Hypertrophic Pyloric Stenosis in Infants: Roentgenologic Differential Diagnosis.** Russel F. Miller and Herman W. Ostrum. *Am. J. Roentgenol.* 54: 17-29, July 1945.

In examining infants suspected of having hypertrophic pyloric stenosis two erect 8 × 10-inch roentgenograms are taken at 6 feet in the postero-anterior and lateral positions within one-half hour of feeding. These include the chest as well as the abdomen, and thus furnish a survey of the lungs and neck for a possible cause of symptoms. The amount of gas and fluid in

the stomach and the distribution of gas in the small intestine are noted. Abnormal collections of gas limited to one area may indicate some congenital malformation such as bands, non-rotation, or anomalous mesenteric attachments. The infant is then placed in the semi-recumbent prone position for three hours or longer in an attempt to get rid of all the gas in the small intestine and most of the stomach gas. This is important, for a gas-distended small intestine will have an effect similar to an "adynamic ileus" and greatly retard gastric motility; it may even cause vomiting. Antispasmodics are administered throughout the examination in an attempt to eliminate the factor of spasm. Roentgenograms are taken at one-half hour intervals in order to record the periodic emptying of the stomach. In the event of good visualization of the duodenal cap, the gastric motor function is considered to be within normal limits even though the emptying time may be prolonged to four to six hours or more. In pyloric muscle hypertrophy, there is no variability in the length of the prepyloric segment and no cycles of gastric motility. There is a rather regular and constant ejection of barium into the duodenum from the time barium is introduced into the stomach. The duodenal cap is never completely filled.

Gastric hyperperistalsis is common in hypertrophic pyloric stenosis. It was never encountered in either complete or partial obstruction distal to the pyloric ring. In hypertrophic pyloric stenosis, vomiting usually occurs for the first time during the third to fifth week of life with a gradual increase in the severity of the symptoms. Anatomically the pylorus shows a fusiform hyperplasia involving the circular muscle fibers of the pyloric canal and terminating abruptly at the pyloric ring. The constriction ranges in length from 0.5 cm. to 3.0 cm. At the antral end the tumefaction is often seen to project convexly into the lumen of the stomach, forming "shoulders" about the proximal aperture of the canal. When congenital bands obstruct the outlet of the stomach, there is an absence of "shoulders." The pyloric canal may be shown to be normal.

The authors report their observations in 50 infants with symptoms of varying severity. The final complete emptying of the normal infant's stomach is so variable that this feature was found to be of little or no diagnostic importance, for not infrequently traces of barium are found ten to twelve hours or longer after ingestion. On numerous occasions, motility did not really begin until the second or third hour or later; then it proceeded normally. Gaseous distention of the colon or a spastic anal sphincter may cause reflex gastric inactivity and absence of motility for hours.

Early signs of pyloric muscle hypertrophy are an orthotonic or hypertonic stomach with intermittent gastric hyperperistalsis. Later the stomach is hypotonic with feeble, shallow peristaltic waves limited almost entirely to the pyloric region. There is prolonged emptying time, not influenced by antispasmodics. CLARENCE E. WEAVER, M.D.

**Cellular Dynamics in the Intestinal Mucosa: Effect of Irradiation on Epithelial Maturation and Migration.** Nathan B. Friedman. *J. Exper. Med.* 81: 555-557, June 1945.

Numerous investigations revealing bizarre degenerative and regenerative phenomena following irradiation



of the gastro-intestinal tract have been reported. The development of numerous mucous cells in the intestinal mucosa has been ascribed to degeneration of the lining epithelium, but little has been known of the mechanism by which the mucous elements appear in such abundance.

The author irradiated male albino rats in groups of 6, giving 1,000 r on one occasion to each of the rats. One or 2 litter mates, which were not treated, were used as controls. During the 96 hours after irradiation the animals were killed at regular intervals by a blow on the head or inhalation of ether. Some were killed after administration of papaverine and magnesium sulfate to counteract smooth muscle spasm. The experiment was repeated five times with similar results for each series of animals. Segments of intestine were taken from the long descending loop of the duodenum and fixed and stained by different methods.

Sections from animals killed within half an hour after completion of irradiation showed nuclear swelling and reduction in the number of mitotic figures. Twelve hours after irradiation no mitoses could be seen, and the nuclei had become swollen and vacuolated sacs; granular masses of chromatin debris from destroyed nuclei were abundant. These changes were confined to the crypts; the cells covering the villi were not affected.

At about 24 hours after irradiation, the crypts, which were normally devoid of fully loaded goblet cells, were seen to contain numerous elements laden with mucous secretion. Between 48 and 72 hours, the epithelial lining cells covering the villi became either abnormally flattened or vacuolated. The clusters of goblet cells disappeared from the crypts and the remaining epithelium became flattened. The aggregations of goblet cells showed progressive migration peripherally as mitosis was resumed. In some animals almost complete recovery appeared in 84 to 96 hours. In such cases the number of argentaffin cells in the intestine was considerably increased.

The author concludes that the accumulation of goblet cells in the crypts after irradiation is due to a transitory arrest in the migration of newly formed elements away from the germinating zone rather than to mucous change in the form of degeneration. The irradiation may have interfered with cellular division without affecting differentiation and maturation.

H. H. WRIGHT, M.D.

**Lymphangioma of the Abdomen. An Unusual Case.** C. F. Murbach, E. F. Lewison, and G. A. Deibert. *Am. J. Surg.* 68: 391-397, June 1945.

An unusual case of lymphangioma of the abdomen is reported. A 35-year-old Army officer after strenuous physical activity suddenly experienced a sharp stabbing pain in the left hypochondrium. This distress later became dull in character, with no radiation and with no gastro-intestinal symptoms. Laboratory studies and physical examination showed essentially normal findings except for a firm mass palpable in the left upper quadrant. This mass was smooth and its margins were difficult to outline, but it was considered to be about the size of a large grapefruit. A small area of tenderness was present where the mass extended beneath the left costal margin. Dullness was present over the entire abdomen, and ascites was considered likely.

Roentgen examination of the upper gastro-intestinal tract revealed an elevation and partial inversion of the stomach. The greater curvature was deformed by a large, smooth, rectangular filling defect produced by an extrinsic mass. The duodenal sweep presented a J-shaped configuration instead of the normal C-shaped appearance. The distal part of the duodenum and all the jejunal loops were displaced into the right upper quadrant. The appearance of the stomach and loops of small bowel suggested a congenital anomaly—failure of rotation of the small bowel. A barium enema showed the entire descending colon to be pushed toward the mid-line. A crescent-shaped filling defect on the lateral aspect of the descending colon suggested pressure by an extrinsic tumor. Intravenous pyelograms clearly indicated that the left kidney was lower than the right and the left ureter was displaced toward the mid-line in a rather precipitous curve. Examination of the chest revealed an elevated diaphragm, the left dome almost as high as the right. A rather dense, band-like oblique shadow was seen in the left lung field extending to the lateral chest wall. This was thought to be either a thickened interlobar fissure or a local area of atelectasis resulting from restricted motion of the diaphragm from increased intra-abdominal pressure.

At operation a tumor weighing 18 1/2 lb. and measuring 60 × 25 × 10 cm. was found. Histologically this proved to be a lymphangioma. The patient made an excellent postoperative recovery. Subsequent roentgenograms showed that the viscera had assumed their normal positions and shape; the area of focal atelectasis had disappeared from the left lung field, and the left dome of the diaphragm had descended to its normal level.

The authors call attention to the relationship between the embryonal origin of the lymphatic system and the sites of predilection for lymphangiomas.

**Nursing—A Source of Error in Cholecystography.** F. Polgár. *Acta radiol.* 25: 174, June 30, 1944. (In German.)

Polgár confirms the observation of Olsson (*Acta radiol.* 24: 489, 1943. *Abst. in Radiology* 45: 634, 1945) that sodium tetra-iodophenolphthalein may be excreted in the milk during lactation, and briefly reports a case. The blue discoloration of the milk lasted about eight hours. In spite of this excretion, the dye visualization of the gallbladder was satisfactory.

ERNST A. SCHMIDT, M.D.

## THE MUSCULOSKELETAL SYSTEM

**Infantile Cortical Hyperostoses: Preliminary Report on a New Syndrome.** John Caffey and William A. Silverman. *Am. J. Roentgenol.* 54: 1-16, July 1945.

The principal features of the new syndrome described by the authors are: onset in the early part of the first year of life; tender swellings in one or more of these sites—face and jaws, scapular regions, and extremities; multiple scattered hyperostoses demonstrable roentgenographically in bones adjacent to the tender swellings and in other bones whose overlying soft tissues appear to be normal both clinically and on the roentgenogram.

In the 4 cases reported by the authors there was no evidence that prenatal deficiency of vitamins or obstetrical trauma was the cause of the infantile

disturbances. In contrast to the multiple massive soft-tissue swellings and extensive scattered hyperostoses, there was a striking paucity of constitutional and systemic manifestations in all stages of the disease. Laboratory findings gave little information of positive diagnostic value. Serological tests for syphilis were all negative. Examinations of the blood revealed no evidence of hemorrhagic disease. Biopsies of affected bones showed only hyperplasia of the lamellar cortical bone; there was no evidence of inflammation or of subperiosteal hemorrhage. The changes in the bones not only do not support the diagnosis of scurvy, but the absence of all the basic scorbutic changes is convincing evidence that the skeletal lesions are not due to deficiency of vitamin C. Pleural exudate was demonstrated in 3 cases with costal thickenings.

The active manifestations subsided completely after several weeks, and there were no serious complications. The cortical thickenings gradually diminished and disappeared after several months. In only one case was there persistent facial swelling, at the age of four and a half years.

In the differential diagnosis scurvy and syphilis must be ruled out. Infection cannot be easily excluded. The possibility of virus infection or allergic reactions as the causal mechanism deserves consideration.

CLARENCE E. WEAVER, M.D.

**Effects of Severe Rickets in Early Childhood on Skeletal Development in Adolescence.** Ethel C. Dunham and Herbert Thoms. *Am. J. Dis. Child.* **69**: 339-345, June 1945.

An interesting follow-up was made during the adolescence of 10 patients treated for severe rickets in early childhood. This group included 6 boys and 4 girls; 1 was a Negro and the 9 white children were of Italian parentage.

Roentgen examination of the pelvis showed rachitic deformity in 5 of the adolescents and no abnormality in the other 5. Three patients having rachitic pelvis were more than four years old when active rickets was diagnosed while 4 patients with normal pelvis were less than three years of age when the disease was discovered. All 10 adolescents had some degree of deformity of the lower extremities. Knock-knees were more often associated with rachitic pelvis than were bow-legs. A high ratio of sitting height to standing height is considered evidence of retardation of growth of the lower extremities. This ratio was found to be high in 8 patients and normal in 1 patient despite the presence of a rachitic pelvis. The remaining patient was not measured.

Of the 10 case histories, 6 are illustrated with photographs of the patient and a roentgen reproduction of the active lesion present in early childhood.

LESTER M. J. FREEDMAN, M.D.

**Echinococcosis of Bone.** M. Beckett Howorth. *J. Bone & Joint Surg.* **27**: 401-411, July 1945.

The author presents a review of the history of echinococcus disease and a discussion of the various reports of echinococcosis of bone. About 1,000 cases of bone involvement have been reported in the literature, including about 10 in North America.

Bone involvement occurs in about 1 per cent of cases of echinococcus disease. The pelvis is involved in

about 36 per cent, the spine in 18 per cent, sacrum in 11 per cent, femur in 17 per cent, tibia in 9 per cent, and the humerus in 10 per cent. Pain, swelling, pathological fracture, and rupture of the cyst are the usual clinical findings.

The laboratory may find scolices, hooklets, or fragments of laminated membrane in the sputum, urine, or feces after rupture of a cyst. Several immunological tests have been developed. Complement-fixation tests and precipitin tests can be done. Aspiration of a cyst may be diagnostic, although there is some danger of anaphylaxis.

Radiologically the cysts are radiopaque. The bone lesions are polycystic, with fairly sharp margins but without productive reaction. Differential diagnosis must be made from giant-cell tumor, cystic tuberculosis of bone, malignant tumor, osteomyelitis, and osteitis fibrosa cystica. The surrounding bone is thinned and may be expanded or ruptured. Necrosis results from arterial occlusion and small sequestra may form. Fracture may occur and non-union may follow.

The treatment is unsatisfactory. Drugs and roentgen therapy are not effective. Excision is the most successful treatment, but amputation may be required.

A lengthy and exact case report of echinococcus bone disease is presented, with numerous roentgenograms.

JOHN B. McANENY, M.D.

**Chronic Melioidosis. Case Showing Multiple Lesions of Bones, Joints and Lungs.** J. H. Mayer. *J. Bone & Joint Surg.* **27**: 479-485, July 1945.

Melioidosis is an infective disease of rodents and man, occurring in the Far East. Several hundred cases have been reported since 1912. In the majority of patients its manifestations are acute, simulating cholera or enteric (typhoid) fever, and death from septicemia has occurred in a few days or weeks. At autopsy abscesses are found in the lungs, spleen, liver, and kidneys. It is assumed that the human infection is acquired through contaminated food or water. Europeans seem to have a greater natural resistance to the infection than natives. The causative organism is the *Bacillus whittmori*, later known as *Pfeifferella whittmori* or *Malleomyces pseudomallei*.

The case reported is that of a 33-year-old British soldier with lumbosacral pain radiating down the thighs, pyrexia, night sweats, and enlarged inguinal lymph nodes that were negative on biopsy. Roentgenograms of the back were normal. Seven months after the onset of symptoms a lumbosacral abscess developed, and later a right sacroiliac abscess appeared. A year later x-ray examination showed collapse of the body of the eighth thoracic vertebra, with paravertebral abscess but no narrowing of the intervertebral spaces. The base of the right lung became extensively infiltrated. About three years after the patient was first hospitalized, *Pfeifferella whittmori* was isolated and treatment with an autogenous vaccine was instituted, with subsequent sulfadiazine therapy. One year later he was well on the way to recovery, with all sinus tracts closed and absence of fever for three months.

At one time the diagnosis was tuberculosis but the bacillus was never recovered. There seem to have been many points of similarity between this infection and tuberculosis of the bone.

This case was previously reported by Mayer and Finlayson (*South African M. J.* **18**: 109, 1944).

JOHN B. McANENY, M.D.

**Osteomyelosclerosis.** G. A. Landoff. *Acta radiol.* 25: 81-94, April 1944. (In German.)

Only about 20 cases of osteomyelosclerosis appear in the literature, and in only 2 was the diagnosis made antemortem. The author has reviewed the material found in the literature and has presented a case of his own, in a woman of fifty-seven, in which the diagnosis was made roentgenologically and verified by biopsy. The roentgen picture, pathognomonic of the disease, reveals a general change in the spongy structure of bone, particularly evident in the pelvis and spine. The bony trabeculae are loosely and clumsily arranged as compared to the normal picture. Histologic study shows complete correlation between the roentgen and microscopic pictures. The latter shows a focal type of medullary fibrosis with new metaplastic bone deposition on the spongy trabeculae. Accumulations of eosinophils are present in the medullary fibrous tissue.

VICTOR KREMENS, M.D.

**Protrusions of Disks and Nerve Compression in the Lumbar Region.** K. Lindblom. *Acta radiol.* 25: 195-212, June 30, 1944. (In English.)

A previous paper by the same author (*Acta radiol.* 22: 711, 1941), in which dorsolateral protrusions of disks at the intervertebral foramina are held responsible for sciatica, is summarized. The present paper represents an extension of the earlier studies, supplementing anatomic findings with clinical observations. The anatomic material consisted of the lumbar portion of the vertebral column obtained from 160 cadavers without reference to clinical symptoms. The clinical observations were based on 732 patients with radiographic examination of abdominal organs, of whom 315 gave a history of lumbago or sciatica. Anatomic studies of disk degeneration and nerve compression were correlated with the clinical records of the cases and the histories of the patients.

As a result of this work, the author feels that symptoms of the sciatica type can be explained on the basis of nerve compression observed in anatomic specimens. These compressions are for the most part outside the vertebral canal, being situated at the outer part of the intervertebral foramina at the point of intersection between the nerve and the disk. In a large majority of the cases, the compression is due to dorsolateral protrusion of a disk. The protrusion in its turn is brought about by degeneration of the disks, characterized by radial fissures, of which those running dorsolaterally play the chief part in producing compression of the nerves.

JOSEPH H. WEISS, M.D.

**Osteochondritis Dissecans of the Supratrochlear Septum of the Humerus.** W. E. Cryslar and H. S. Morton. *Am. J. Roentgenol.* 54: 41-46, July 1945.

It is believed that as the humerus develops, a possible disturbance of local blood supply may occur and account for the loss of continuity resulting in a supratrochlear foramen in one case and the development of the nucleus of an osteochondritis dissecans in another. The vascular disturbance may be incident to minor trauma. The roentgenogram in the classical case discloses a circular button of bone lying in the olecranon or coronoid fossa intimately in contact with the lower and intra-articular portion of the supratrochlear septum. Partial or complete extrusion into the joint space may occur. In some cases, the nucleus may be

fragmented. In others, the supratrochlear septum has an irregular density suggesting multiple incomplete defects or excavations. It was generally found that the opposite elbow revealed either an unusually thin or a perforated supratrochlear septum.

The patients complain of pain and limitation of motion at the elbow. Some of these patients do well with conservative treatment. If there has been an extrusion of the sequestrum, locking may occur. Removal of the osteochondritic ossicle in 5 cases led to complete recovery without known recurrence of symptoms. Histopathologic examination of the removed ossicles disclosed characteristics similar to those of osteochondritis dissecans found elsewhere.

The lesion described has previously been confused with sesamum cubiti. CLARENCE E. WEAVER, M.D.

**Osteitis Condensans Ilii.** Hugh F. Hare and G. Edmund Haggart. *J. A. M. A.* 128: 723-727, July 7, 1945.

The roentgenologic finding of increased bone density in that portion of the ilium which immediately borders the sacroiliac joint is described and discussed in detail. Twenty-three examples encountered by the authors in one calendar year are reported. In every instance the finding was observed in women between the ages of twenty-three and thirty-eight years presenting the chief complaint of low-back pain with or without radiation. No causative factor has been identified. Features which differentiate this syndrome from Marie-Strümpell disease are enumerated. Symptomatic treatment, augmented by operative fusion of the sacroiliac joints in refractory cases, is suggested.

FRED JENNER HODGES, M.D.  
(University of Michigan)

**Epiphysitis of the Ischial Tuberosity: Case Report.** Paul E. McMaster. *J. Bone & Joint Surg.* 27: 493-495, July 1945.

This is a complete case report of a 19-year-old male with a history of repeated injuries to the region of the left ischium. The original injury was quite severe; the subsequent traumata were less so but sufficient to disable the patient. At the time of this study, the epiphysis of the left ischial tuberosity was ununited and greatly enlarged, possibly four times its normal size. The center for the right ischial tuberosity had united and this bone appeared normal.

JOHN B. MCANENY, M.D.

**Pneumarthrograms of the Knee. A Diagnostic Aid in Internal Derangements.** W. H. McGaw and E. C. Weckesser. *J. Bone & Joint Surg.* 27: 432-445, July 1945.

The authors have made 508 pneumarthrograms of the knee. Under aseptic precautions and local infiltration anesthesia a 20- or 22-gauge needle is inserted into the lateral infrapatellar space and fluid is withdrawn. The joint is then gently distended with oxygen, usually 80 to 100 c.c., and the needle is withdrawn. Films are made in the anteroposterior and postero-anterior projections with spread of the medial and lateral joint spaces. A lateral view in slight flexion is also made. The joint is spread by pressure against its side and counter pressure above and below it. The central ray is directed exactly through the joint space.

The anatomy of the medial meniscus is so simple that any abnormality here is indicative of a lesion. In the lateral joint space the popliteus muscle causes some confusion with the meniscus. The course of this muscle is downward, backward and medially, crossing the posterior aspect of the lateral joint space.

The changes seen are irregularity, blunting or shortening, partial or complete absence, and abnormal size of the meniscus. The synovial cavities and bursae can be defined and the condition of the articular surfaces observed.

Illustrative cases are presented and reproductions of several abnormalities are offered.

JOHN B. McANENY, M.D.

#### A Third Routine X-Ray Exposure of the Ankle Joint.

R. S. Simon. *J. Bone & Joint Surg.* 27: 520, July 1945. It is suggested that in order better to demonstrate fractures of the lateral malleolus, a view of the ankle be taken with increase of external rotation of the foot, so that the heel is elevated 4 cm. above the film and the tube angulated 30 degrees anteriorly. This position throws the distal tibia anterior to the distal fibula.

JOHN B. McANENY, M.D.

#### Rotational Deformity in the Treatment of Fractures of Both Bones of the Forearm.

E. Mervyn Evans. *J. Bone & Joint Surg.* 27: 373-379, July 1945. The usual rule of immobilizing fractures of both bones of the forearm in full supination for those of the upper third, and in mid-position for those of the middle and distal thirds, is not always satisfactory. The author has demonstrated that the exact position of fixation of a fracture can be determined by noting the position of the radial tuberosity in a special view of the upper forearm and placing the distal fragment in the corresponding phase of rotation.

The "tuberosity view" is made with the dorsum of the forearm on the film, the elbow flexed at 90 degrees, both condyles of the humerus at the same level from the film, and the tube angled 20 degrees cephalad. In this view the position of the tuberosity of the radius is estimated, and a view of the normal elbow is made in the same degree of rotation to check. At reduction the amount of rotation in which the distal fragment is to be placed is predetermined, and immobilization is maintained exactly in the correct amount of rotation.

The author advises that a chart be made by obtaining, on the same film, successive views of a normal radius in various degrees of rotation, so that the examiner will be familiar with the appearance of the tuberosity in the various phases of rotation.

JOHN B. McANENY, M.D.

#### Parachute Fractures.

Paul A. Knepper. *Surg., Gynec. & Obst.* 81: 53-55, July 1945. A survey of the fractures which occurred in a regiment of paratroop infantry during a six-month period of intensive training is presented. A total of 129 fractures occurred, of which 79 involved the lower extremities. Fracture of the posterior lip of the tibia is the typical "paratrooper fracture," occurring when the weight of the body is transmitted through one foot instead of being divided.

For treatment of these fractures of the posterior lip of the tibia a padded plaster cast is applied with the foot in the neutral position and the ankle in 90 degrees dorsi-

flexion, and absolute bed rest is enforced for one week. The cast is then replaced by another which has a very small amount of padding. After forty-eight hours, weight bearing is permitted on the cast without crutches. After two weeks the cast is removed and physiotherapy is carried out daily for one week. The patient then returns to full duty. J. L. BOYER, M.D.

#### Fatigue Fracture.

A. Ronald. *Brit. J. Surg.* 33: 90, July 1945.

A brief case report of bilateral fatigue fractures of the fibula.

### THE GENITO-URINARY SYSTEM

#### Administration of Contrast Medium in Urography via the Bone Marrow.

Lennart Walldén. *Acta radiol.* 25: 213-218, June 30, 1944. (In English.) The author experimented with the administration of the contrast medium for urography by way of the bone marrow. Hypertonic solutions are contraindicated and, since most water-soluble iodine compounds used in urography are hypertonic, they must be diluted with sterile water until isotonic. Two hundred cubic centimeters of the diluted medium (10:1) was injected into the sternum. This was absorbed in five minutes, and films of as good quality as those made following injection by the intravenous route were obtained.

This method has proved valuable in cases where the intravenous route for various reasons could not be used. It should be of particular value for urography in children.

JOSEPH H. WEISS, M.D.

#### Miliary Tuberculosis after Retrograde Pyelography Report of a Case.

Åke Lindbom. *Acta radiol.* 25: 219-223, June 30, 1944. (In English.) During retrograde pyelography, an acute pyelovenous backflow took place in a patient suffering from serious unilateral renal and ureteral tuberculosis. A large quantity of the bacteria-rich content of the renal pelvis came thereby directly into the blood. The patient died from miliary tuberculosis three weeks later. The author concludes that in cases where tubercle bacilli are found in smears of urinary sediment, retrograde pyelography of the suspected kidney should be avoided.

JOSEPH H. WEISS, M.D.

#### Pathologic and Anomalous Conditions Associated with Duplication of the Renal Pelvis and Ureter.

Ruy Goyanna and Laurence F. Greene. *J. Urol.* 54: 1-19, July 1945. Complete duplication of the renal pelvis associated with complete or incomplete duplication of the ureter is a common anomaly; it was found 25 times in 2,000 consecutive autopsies at the Mayo Clinic. It is in itself of little significance but becomes significant in making the diagnosis of a coexisting pathologic state more difficult.

The most common pathologic condition found associated with duplication in the authors' series was hydronephrosis or hydroureter or both. This was almost twice as common in the lower as in the upper segment. A table of the various associated conditions in a series of 131 patients seen in a ten-year period is given.

The diagnosis of duplication is usually made without much difficulty by means of an excretory urogram. However, if one of the segments is non-functioning,



the excretory urogram may appear normal. In these cases suggestive signs are: (1) an elongated renal shadow, (2) presence of a region of kidney with no means of drainage, (3) characteristic shape of the visualized pelvis. In typical cases, the upper pelvis is usually small, with two major calices. Less frequently only one major calix is present, and least commonly three may be observed. In the lower pelvis the position of the upper calix is typical. The calix extends laterally rather than superiorly, as commonly seen. Probably the most reliable sign of duplication, however, is the elongated renal shadow associated with a large area of kidney with no visible means of drainage.

Cystoscopy and retrograde pyelography are frequently of value in visualizing the pelvis not seen by excretory urography, but even these may fail when the supernumerary orifice is hidden or duplication is incomplete. A history of congenital incontinence associated with normal micturition is strongly suggestive of duplication with ectopic ureter.

Three case reports are given with reproductions of roentgenograms.

ARTHUR W. PRYDE, M.D.

#### **Bilateral Crossed Renal Ectopia: A Case Report.**

Charles M. Norfleet, Jr. *J. Urol.* 54: 10-11, July 1945.

A case of bilateral crossed renal ectopia, the twenty-fourth to be recorded in the literature, is presented. The diagnosis was made by retrograde urography.

#### **Aneurysm of the Renal Artery.**

Bernard Levine. *J. Urol.* 54: 17-21, July 1945.

A case of true aneurysm of the right renal artery is

presented in which laminagraphy proved a valuable aid in establishing the diagnosis. Aneurysm of the renal artery is relatively rare, only 76 cases having been reported in the literature. Of these cases only 13 were diagnosed prior to operation or death.

The author's patient was a 59-year-old woman complaining of a constant, boring, non-radiating pain in the right loin of about fifteen years' duration. Two months prior to hospital admission, she had a single episode of hematuria. Physical examination was negative except for slight right costovertebral tenderness. Blood pressure was 170 systolic and 90 diastolic. Laboratory studies showed good function of both kidneys. A gallbladder series revealed a normal gallbladder but a wreath-like calcific shadow was seen on the films medial to the right kidney above the hilar notch. A right retrograde pyelogram made at this time showed a normal configuration of the kidney pelvis and calices. Films taken in different positions showed that the ring-like shadow moved with the kidney. A tentative diagnosis of aneurysm of the renal artery was made. Laminagrams of an excretory urogram showed the calcification to be at the same plane as the right renal pelvis, tending to confirm the diagnosis. Operation was performed through a transperitoneal approach and revealed a pulsating mass about the size of a walnut which was adherent to the medial aspect of the right kidney and to the lateral aspect of the vena cava. The aneurysm was dissected free and the kidney mobilized and removed with the aneurysm. The patient made an uneventful recovery.

JOHN H. FREED, M.D.

## **RADIOTHERAPY**

#### **Treatment of Bilateral Retinoblastoma (Retinal Glioma) Surgically and by Irradiation. Report on Progress.**

Hayes Martin and Algernon B. Reese. *Arch. Ophthalmol.* 33: 429-438, June 1945.

In 1936 (*Arch. Ophthalmol.* 16: 733, 1936), the authors described a new technic for treatment of bilateral retinoblastoma and reported on the progress up to that date in 6 patients, all of whom had then been observed for less than five years. The principles of this method of treatment were: first, the surgical removal of the eye with the more advanced involvement; second, fractionated roentgen irradiation of the remaining eye in an attempt to conserve vision. In 1942 (*Arch. Ophthalmol.* 27: 40, 1942), a second report was published, adding 4 new cases, and describing certain modifications in the technic. In the present communication the authors present the follow-up data in the cases previously reported and record the results to date of treatment in 14 additional cases, making a total of 24 cases of bilateral retinoblastoma treated by this method.

Nine patients were treated five or more years ago. In one case, the result was indeterminate. Two of the remaining 8 patients died from the retinoblastoma, 2 are living without recurrence and with vision, and 4 are living without recurrence but are blind. Of the 14 patients treated during the last five years, 3 have died of the disease or have a hopeless recurrence; 3 are regarded as partial failures, for although the growth appears to be under control, the patients are blind; 8 have freedom from disease with vision.

The intraocular changes and the complications fol-

lowing fractionated roentgen radiation therapy in cases of retinoblastoma are described in the two preceding reports; supplementary information on the effects of radiation on retinoblastoma and on the eye in general is given here.

Data on the apparatus, the irradiation factors, and the technic of application are briefly summarized in the present report; for a more detailed description the reader is referred to the earlier papers.

#### **Response to Preoperative Irradiation as a Clue to the Management of Breast Cancer.**

Leo M. Levi. *Am. J. Surg.* 68: 355-357, June 1945.

A series of 131 cases of breast cancer was studied to determine if the response to preoperative irradiation gave any clue as to the best management of the disease. The customary daily dose was 300 r (in air) given through a 10 × 10-cm. supraclavicular port and to each of two opposing breast portals (usually 10 × 15 cm.) for a total of 1,800 r each. The axillary field (10 × 10 cm.) received 1,500 r. The factors were 200 kv., 50 cm. T.S.D., 0.5 mm. Cu plus 2.0 mm. Al filtration, 1.0 Cu h.v.l., intensity 35 r per minute. The skin effect was seldom more than a brisk dry erythema. Surgery was performed four to six weeks later.

The tumors of 53 patients underwent striking regression, i.e., there was such a marked diminution in the mass that it was described as only "an indefinite thickening" or "no palpable tumor." Of this radiosensitive group, 29 had radical mastectomies, while 24 had no subsequent surgery. The patients were followed for



periods ranging from six months to six years. Eleven of the 29 who received irradiation, with a subsequent radical mastectomy, and 14 of the 24 patients treated by irradiation alone, survived. The average interval from treatment to the appearance of metastasis in the irradiated patients with surgery was 10.77 months, in those treated by irradiation alone, 16.22 months.

The plan of classification and treatment for breast cancer followed at the Los Angeles County Hospital is presented.

**Present Status of Diagnosis and Treatment of Uterine Carcinoma.** Hugh F. Hare. *Surg. Clin. North America* 25: 536-541, June 1945.

This brief article from the Lahey Clinic reviews the dependable ways of diagnosing and treating cancer of the uterus. While the vaginal smear technic is used, the author states that sole dependence is not to be placed on this method; it is, furthermore, reliable only in the hands of a highly trained man. Routine biopsy with stout adaptable biopsy forceps is done in all cases of cervical ulceration.

The method of treatment at the Lahey Clinic in early (Grade I) lesions is surgical excision. In more advanced lesions the author recommends external irradiation given to 4 portals (2 anterior and 2 posterior) at the rate of 100 r a day to a total of 2,000 r to each portal. He then goes on with the misleading figure, "8,000 r" total in air; in other words, a summation of the dosage to the four fields. Following external irradiation, radium is applied within the uterus, 3,000 mg. hr. in each of two sittings, 50 mg. being placed in the uterine end of the tube and 150 mg. in the cervical end. Two or three weeks later, interstitial radium is used with a similar dosage "into and around the lesion."

While no figures are given, considerable success is claimed, exceptions being those cases in which the disease has invaded contiguous structures, namely the bladder and rectum.

Surgical removal of carcinoma of the body or fundus is followed by external irradiation given as outlined above.

The author points out that vigorous irradiation of the patient with hopelessly advanced disease is not warranted; he feels that treatment in such cases should be given for palliation only.

One interesting side light which is brought out is the seeming confusion to be found in the literature on the treatment of carcinoma of the uterus with irradiation. It is pointed out that shock-proof apparatus of 200, 400, and 1,000 kv. were developed almost simultaneously, and at approximately the same time more accurate measuring of dosage and applications of depth dose (as well as isodose charts) were put in use.

SYDNEY F. THOMAS, M.D.

**Paget's Disease on the Nipple with Special Reference to Its Course and Treatment.** Karen Lübschitz. *Acta radiol.* 25: 127-148, April 1944. (In English.)

This study, emanating from the Radium Centre in Copenhagen, presents a review of the history of Paget's disease, the various conceptions of its pathogenesis, and an analysis of 27 cases of Paget's disease of the breast with respect to diagnosis and therapy.

A cross section of the pertinent literature since 1876 fails to resolve the question as to whether the super-

ficial eruption on the nipple and the areola is a cancer or a precancerous affection, and what the inherent connection is between this superficial lesion and the cancer which develops in the breast.

Relatively few cases of Paget's disease have been reported as treated by roentgen irradiation. The author has utilized and attempts to evaluate this treatment in 25 cases. In all cases but one the diagnosis was verified by histologic examination. In 15 cases roentgen therapy was the only treatment employed, and in a group of 10 cases surgery was performed at a later date, owing, as a rule, to recurrence. The technic and dosage were not uniform, but the majority of cases received a total dose of 4,000 to 6,000 r. The irradiation varied from low-voltage (60 kv., 2 to 4 ma., 0.1 mm. Cu filtration, distance 5 to 7 cm.) to slightly deeper treatment (100-180 kv., 2 to 4 ma., 1 to 3 mm. Al, distance 15 to 40 cm.).

The author at the time of publication states that this technic and dosage are now considered inadequate, despite the fact that in 5 cases out of 14 dating back more than five years not only was the Paget's lesion on the breast completely healed, but for a considerable number of years no tumor formation has appeared in the deeper part of the mammary gland. It is now felt that in those cases of Paget's disease where advanced age or complications of other kind increase the risk of, or contraindicate, operation, there will be, as in technically inoperable cases, reason to attempt curative roentgen treatment. This must be accomplished by fractional, protracted irradiation of the entire breast and axilla with a total dose of at least 4,000 r in about four weeks.

The conclusion reached is that there is a prospect, with improved technic, of a curative effect without surgery, but it is stressed that as yet no such convincing results have been obtained as would justify the use of roentgen therapy alone. For the present the normal procedure in every case of Paget's disease must, as far as possible, be to use radical surgery after the same principles as in operable mammary carcinoma, utilizing the benefits of strong, fractional, preoperative irradiation.

It will no doubt take some time before it will be possible, on the basis of clinical observation, to come to a safe estimate of what may be accomplished by roentgen treatment alone in this disease, especially since the condition is a relatively uncommon one.

VICTOR KREMENS, M.D.

**Irradiation Failures in Early Cervical Cancer. Improved Irradiation or Return to Surgery?** Franz Buschke and Simeon T. Cantril. *Am. J. Roentgenol.* 54: 60-69, July 1945.

It is now generally accepted that statistically the results of adequate radiation therapy are superior to those of the radical Wertheim hysterectomy in the treatment of epidermoid carcinoma of the cervix in all stages. Adequate radiation therapy yields results at least equal to excellent surgery, if the problem is viewed from a statistical point of view. In those instances in which surgeons have become disappointed with irradiation results, a critical analysis shows that those results were not up to par, i.e., the cure rates are lower than those which have been attained by the leading radiological institutions, which must be considered as the standards for comparison. The fact remains that now, as fifteen years ago, 20 per cent of Stage I and at least

30 per cent of Stage II cases are not cured by even the most competent and skillful radiation therapists. The reason for this may be found in a careful analysis of the individual unsuccessfully treated cases.

An analysis is made of failures in cases treated by the authors between 1935 and 1938. Nineteen patients out of a total of 79 with cancer of Stage I or II are dead or show active disease. Three patients with controlled carcinoma died of complications secondary to an intestinal irradiation necrosis, one of them combined with a necrosis of the bladder. These patients were treated when the dangers of supervoltage roentgen therapy were not sufficiently understood or appreciated. In the early stages severe intestinal reactions are today considered as due to faulty treatment. One patient who died of sepsis was given intracervical radium therapy before a pelvic cellulitis was properly controlled. Two patients might have been saved by a better spatial distribution of the dose. Four patients are listed as unexplained failures. They all died of parametrial recurrence. The treatment in these 4 cases was considered adequate according to today's standards. None of the failures in this series was due to uncontrolled or recurring cancer in the cervix itself. A radium dose below 8,000 mg. hr. (with adequate distribution in space and time) cannot be considered adequate even if one occasionally seems to obtain results with less.

It seems from clinical observation and from analogies that radiation therapy can control pelvic disease beyond the cervix if it represents a diffuse direct invasion through the lymphatics of the broad ligament, but not disease of the lymph nodes. Admitting that there is a small group of cases for which a permanent cure with our present methods of radiation therapy is unlikely, the question arises as to their actual chances if surgery is used. Taussig (*Am. J. Obst. & Gynec.* 45: 733, 1943) recommends for Stage II cases a combination of radiation therapy to the cervix and its immediate neighborhood and iliac lymphadenectomy. One objection to this is that no attempt is made to remove the lymph nodes around the lower portion of the ureters because this would make the operation more complicated and risky, and a second objection is that, after intensive radiation therapy by a combination of a maximum radium and a maximum roentgen dose, a procedure such as iliac lymphadenectomy carries considerable risk. The statistical evaluation of Taussig's results, in which he computes a 68 per cent greater salvage than by irradiation alone, seems erroneous. By analyzing the irradiation procedure used for comparison with his, the authors found that the irradiation applied in that series has been greatly improved through the years. Yet the earlier cases were apparently included in the material for comparison.

It seems quite logical that, if surgery is done, it should be in the form of the radical Wertheim operation without considering radiation therapy. Meigs (*Surg., Gynec. & Obst.* 78: 195-199, 1944) has recently revised this classical procedure. Of the 65 patients operated upon by him, 53 had no cancerous lymph node involvement. Two of these are dead. In 12 cases the lymph nodes were involved. Three of this group are dead. Thus, out of a group of 65 patients, 9 were saved who would not have been saved by irradiation, granting that radiation cannot sterilize lymph node metastases. This means that 20 patients have to be subjected to this radical operation in order to save 3

that could not have been saved otherwise. Meigs' requirements are very strict. Ideally, the patient should be thin, young, in good health, and have an early cancer. Three of the authors' cases which were failures would not have been accepted for surgery according to Meigs' rigid standards.

It is felt that improvement of radiation therapy by more careful attention to details of technic, by the elimination of inadequate procedures of the past, and by the careful adaptation of the procedure to the individual requirements will probably save more patients than a return to surgery.

CLARENCE E. WEAVER, M.D.

**Hodgkin's Disease. Salient Clinical Features and Relative Value of Various Methods of Treatment Based upon Study of 319 Cases.** Leonard B. Goldman and Abraham W. Victor. *New York State J. M.* 45: 1313-1318, June 15, 1945.

The authors discuss the salient clinical features and the relative value of various methods of treatment of Hodgkin's disease based on a study of 319 histologically proved cases. Of this series, 193 were observed until death and 69 had complete postmortem studies.

The chief complaint of the majority of patients when seeking medical aid is a "swelling," usually in the neck. Deft palpation of the involved lymph nodes may permit a clinical diagnosis of Hodgkin's disease. The nodes are irregular, resilient, and differ in consistency, depending on the histologic picture. Matting may or may not be present. Elastic, relatively soft nodes indicate marked parenchymal proliferation and such nodes regress more rapidly under radiotherapy than firmer nodes attached to surrounding structures. In 13 of the patients there was involvement of lymph nodes at the edge of the sternum along the course of the internal mammary artery. The authors consider these prominences to be pathognomonic of Hodgkin's disease.

Pleuritis was an outstanding symptom. One hundred and twenty-four patients showed diverse cutaneous manifestations, but only a few of these presented a microscopic picture characteristic of the disease. The most common finding was small, scratched papules. Herpes zoster was present in 24 cases. Subcutaneous nodules were found in only 2 cases. This is in contrast to lymphosarcoma, in which the subcutaneous tissues and mucous membranes are frequently involved while the skin is spared.

The mediastinum is frequently involved but seldom without coexistent adenopathy in the cervical, supraclavicular, or axillary regions. The parenchyma of the lung showed involvement in 25 of the patients, with lesions varying in size from 2 to 7 mm. Bloody pleural fluid, obtained by paracentesis, was rare.

The gastro-intestinal tract was involved in only 2 cases, the stomach in one and the sigmoid in the other, in contrast to its frequent involvement in lymphosarcoma. Fourteen patients showed obstructive jaundice, usually indicative of compression of the biliary duct system. The jaundice disappeared following irradiation. Splenomegaly was not an early finding and was not marked in degree in later cases. In 27 of the patients the disease was confined almost entirely to the abdominal cavity.

Bone involvement was present in 20 patients. No characteristic roentgenographic picture was seen, the lesions in most instances being osteolytic and indis-

tinguishable from metastatic carcinoma. The vertebral column was the most frequent site of involvement.

The white blood count was normal in most cases. Where leukopenia was present, it was not considered a contraindication to irradiation, provided heavy roentgen therapy had not already been administered. A mild secondary anemia was usual. Sternal aspirations in 91 cases showed one or more of the following characteristic findings; a polymorphonuclear shift to the right with marked toxic granulation; increase of eosinophilia of young myeloid elements; increase in the monocyte series.

Pregnancy occurred in 11 patients and in none was there evidence that the course of the disease was altered or that there was any effect on the offspring.

With proper treatment, useful life of the patient may be prolonged for many years, although permanent arrest of the disease is not to be expected. The authors advocate the smallest quantity of radiation that is compatible with the patient's relative well being, just sufficient to cause gross disappearance of involved lymph nodes. The first area treated is the site of the patient's chief symptom or the most prominent site of involvement. A voltage of 200 kv. with a filtration of 0.5 mm. Cu and 1 mm. Al was used in most instances. Higher and lower voltages appeared to give inferior results. Constant supportive hematologic therapy is advocated.

H. H. WRIGHT, M.D.

**Therapeutic Use of Radioactive Phosphorus.** Shields Warren. *Am. J. M. Sc.* 209: 701-711, June 1945.

Radioactive phosphorus produced in a cyclotron by the bombardment of red phosphorus placed in the external target chamber gives a product of relatively low specific activity. Bombardment of an iron phosphide probe placed in the deuteron stream gives a product of high specific activity.

The chemical manipulation which converts the phosphorus to dibasic sodium phosphate has no effect on the radioactivity. The half life of radioactive phosphorus, 14.3 days, is long enough to permit the chemical manipulations necessary to prepare it for administration without undue loss of activity. The half life is short enough to have no long-range harmful effects on the body. The beta rays given off have relatively low penetrating power (2-4 mm. of tissue), and the end product of the reaction, sulfur, is not radioactive and is harmless. It has been calculated that 0.1 microcurie of radioactive phosphorus has the same ionizing effect as 4.2 r of therapeutic roentgen rays delivered per gram of tissue in twenty-four hours.

Radioactive phosphorus was administered as disodium acid phosphate, or as magnesium ammonium phosphate, or even as phosphoric acid. The desired dose was usually given intravenously in 300 c.c. of normal saline and 5 per cent glucose solution in adults, or in a volume of 100 c.c. in children. When given orally, the material was dissolved in 150 c.c. of orange juice. With this method, from 20 to 30 per cent of the dose was not absorbed because of precipitation in the gastro-intestinal tract of a portion as insoluble phosphates.

The highly radiosensitive diseases such as leukemia and the lymphomas were treated. It was decided to limit the treatment to cases which had become resistant to roentgen rays, and to the acute leukemias of childhood, which are known to do badly with roentgen irradiation.

Thirty-one cases had been treated with roentgen

rays and had either failed to respond or proved to be resistant from the start. Fifty cases had had no previous radiation therapy. The cases which were helped showed definite clinical and laboratory evidence of improvement for a period of three months or more. The best results were obtained in previously untreated cases of chronic and subacute myelogenous leukemia and in cases of lymphatic leukemia previously treated with roentgen rays. The cases of leukemia in children did badly.

The degree of leukemic infiltration of the bone marrow is important, since, if the involvement is extensive and normal hematopoiesis is slight, the change will be only from a leukemia to an aplastic anemia. Therapeutic doses of radioactive phosphorus do not appreciably damage red cell formation. Radiation sickness was encountered only once.

Owing to the ready diffusibility of the phosphate ion, radioactive phosphorus permeates all of the body tissues and fluids, but the leukemic tissue picks up a considerably higher concentration than does normal tissue. Certain tissues, as liver, kidney, spleen, and bone marrow, show proportionately large amounts of the radioactive substance. Soon after administration, the concentration in the saliva is as much as that in the blood. The normal spinal fluid does not attain any appreciable amount until a number of days has passed. Several days after injection, the bile may contain large amounts, owing to the selective action of the liver.

Intravenously administered radioactive phosphorus is practically all excreted by the kidneys. Appreciable amounts of the substance in the feces indicate intestinal hemorrhage or extensive mucosal leukemic infiltration.

BENJAMIN COLEMAN, M.D.

**Radioactive Phosphorus in the Treatment of Polycythemia Vera. Results and Hematologic Complications.** Byron E. Hall, Charles H. Watkins, Malcolm M. Hargraves, and Herbert Z. Giffin. *Am. J. M. Sc.* 209: 712-717, June 1945.

Radioactive phosphorus was employed intravenously for the treatment of 12 cases of polycythemia vera. The initial dose varied from 4 to 7 mc., and second and third injections were given whenever the material was available. Satisfactory remissions were induced in 8 of the 12 cases. Incomplete remissions occurred in 2 cases and were probably due to inadequate treatment. When satisfactory remissions occurred, both clinical and hematologic improvement were noted. The remissions have lasted from eight to twenty-six months.

There was noted considerable variation in the doses required to induce satisfactory remissions. While Lawrence and his associates (*Radiology* 39: 573, 1942) recommended 2 injections of 7 mc. each, three weeks apart, it was found that many, presumably milder, cases responded satisfactorily to a single injection containing as little as 4 mc.

There were no toxic reactions or evidences of radiation sickness. However, such complications as anemia, leukopenia, and thrombocytopenia were observed in several cases. Acute leukemia developed in one patient who had symptoms attributable to polycythemia vera for three and one-half years prior to the administration of radioactive phosphorus. Death occurred eighteen months after a single injection of 7 mc. While on a theoretical basis there may be a

causal relationship between the administration of radioactive phosphorus and the occurrence of acute leukemia, the material had lost its radioactivity long before the leukemia developed, and in other patients receiving treatment over longer periods of time this disease did not occur.

The effectiveness of radioactive phosphorus in treatment is well established. Patients may not only obtain complete relief, but they require no other forms of therapy. The dose must be individualized for each patient.

The action of radioactive phosphorus is similar to that of roentgen therapy to the bone marrow, in that erythropoiesis is decreased. Although hematologic complications may occur, serious bone marrow damage can be averted by frequent hematologic studies.

BENJAMIN COPELAND, M.D.

**Roentgen Therapy of Arthritides.** Ira I. Kaplan. *New York State J. M.* 45: 1339-1343, June 15, 1945.

The widespread incidence of arthritis and the failure of the usual methods of treatment to provide cure or lasting relief in any large proportion of cases emphasize the importance of giving serious consideration to radiation therapy.

Many reports, particularly in the recent literature, indicate roentgen therapy to be of definite benefit in the arthritides. It is most effective in infectious arthritis, rheumatoid arthritis, and Marie-Strümpell disease. Most workers emphasize the value of radiation therapy in reducing pain and increasing function of the involved joints. Some claim cure from irradiation in early stages of arthritis. Others have noted no anatomic change demonstrable roentgenographically following treatment. The response is most satisfactory in cases treated early.

Bursitis and peritendinitis calcarea in the acute and subacute stages show excellent response to roentgen therapy, which in the opinion of many workers is the treatment of choice for these conditions.

H. H. WRIGHT, M.D.

## TECHNIC AND DOSAGE

**Evaluation of Different Factors in Rotation Therapy.** Sv. Hoeffler Jensen, Jens Nielsen, and V. Thayssen. *Acta radiol.* 25: 95-104, April 1944. (In English.)

Rotary roentgen irradiation has of late been the object of considerable interest and had been dealt with in a number of papers. Up to the present some 150 cases of esophageal cancer have been treated by rotation therapy by the authors.

The distribution of the dose in the irradiated body can be determined either indirectly by calculation or directly by measurement on suitable phantoms. The authors conclude that the indirect method is frequently uncertain and too time-consuming. Direct measurement on suitable phantoms is the method to be preferred.

Rotary irradiation may be characterized by a statement of the relation of skin dose to axis dose. This relation is dependent on the focus-axis distance, the half-value layer of the radiation, the object size, the field used, and the shape and density of the object. When the focus-axis distance and the h.v.l. are as great as possible, and the field size and phantom density are as small as possible, the best ratio of skin dose to axis dose is obtained. Absolute and relative

values of tumor dose with respect to varying chest circumferences have been determined by direct measurements in the esophagus in patients receiving rotary irradiation.

One hundred and eighty kilovolts, 15 ma., 0.5 mm. Cu, and a focus-axis distance of 50 cm. represent appropriate factors for rotary irradiation of esophageal cancer.

VICTOR KREMENS, M.D.

**Dose Distribution in Rotary Irradiation of Eccentrically Situated Axial Field as Basis for Experiments with Rotation Treatment of Cancer of the Rectum.** Paula Wissenberg. *Acta radiol.* 25: 105-112, April 1944. (In English.)

"The object of this study has been to determine, experimentally and clinically, whether it is possible by rotary irradiation of an eccentrically situated tumor, when the tube rotates 180 or 360 degrees about an axis in the tumor, to obtain such a distribution of the dose that there is reason to expect a more favorable effect than by irradiation through stationary fields."

Esophageal cancers, as compared to eccentrically situated rectal lesions, may be considered as being centrally situated. A nearly homogeneous irradiation in the axial field and a rather sharp drop of the dose outside the latter can be obtained in centrally situated lesions, with a ratio of about 1 to 3 existing between surface dose and maximum (tumor) dose. A different and less advantageous intensity curve is obtained in the case of eccentrically placed tumors.

A cylindric paraffin phantom was used for estimation of the tumor dose which could be obtained by rotary irradiation of cancer of the rectum. Measurements were made with a spherical ionization chamber (condensimeter chamber) about 1 cm. in diameter placed in holes bored in the phantom. Measurements were made with reference to (1) 180 or 360 degrees rotation; (2) size of the field; (3) position of the axis; (4) focus-axis distance.

Results indicate that "rotary irradiation of an eccentrically situated axial field does not give as good distribution of the dose as centric radiation over an arc of 360 degrees. Homogeneous irradiation of the tumor region cannot be obtained." It is questioned whether a markedly greater tumor dose can be delivered than by irradiation through fixed fields. It is true, however, that intersecting of the beams of the fixed fields is avoided.

The clinical results of rotation treatment of 19 cases of inoperable cancer of the rectum are reviewed. The effect on the tumor does not seem greater than that obtained by irradiation through multiple fixed fields. There is, however, the advantage of shorter treatment time and less discomfort to the patient.

VICTOR KREMENS, M.D.

**A Slide Rule for Determination of Dosage from Linear Radium Applicators.** G. Rudinger. *Am. J. Roentgenol.* 54: 72-77, July 1945.

The author summarizes his paper as follows: "A multiple slide rule is described which permits quick calculation of the dose delivered by radium or radon needles as used in gamma-ray therapy. It can also be used for rapid determination of relations between quantities affecting the dose. The theory of the design is outlined and some details are given regarding the mechanical construction of a simple model. The accuracy obtainable is sufficient for clinical use."

CLARENCE E. WEAVER, M.D.



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